AIR FORCE HUMAN RESOURCES LABORATORY

REMOTELY PILOTED VEHICLES DESIGN OPTION DECISION TREES

By

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AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235

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This technical report has been reviewed and is approved.

GORDON A. ECKSTRAND, Director
Advanced Systems Division

Approved for publication.

HAROLD E. FISCHER, Colonel, USAF
Commander

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A multiphased study effort was conducted to lead to the development of methods for determining the components and measuring the effects of advances in technology on human resources in Air Force weapon systems. A first phase of the effort involved the conduct of an analysis of the literature to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resource parameters (AFHRL-TR-74-71). The second phase involved the development of Design Option Decision Trees (DODT) for two areas of Air Force systems technology (Digital Avionics Information System and Remotely Piloted Vehicle Systems). The third phase called for the development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources. The fourth phase involved

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application of the method developed under phase three. The fifth and last phase entailed making an evaluation of the usefulness of the method to system designers and planners.

A method integrating the DODT with a modification of the method of summated ratings was developed to arrive at a quantification of human resource effects of technological innovations. This procedure was applied to the Digital Avionics Information System DODT to provide source data for the evaluation of the developed method. The DODTs developed for the RPV system are presented in this volumn.

SUMMARY

PROBLEM

The introduction of a new weapon system has a major impact on the human resource parameters of the Air Force. Depending upon the unique aspects of the weapon system, it may require new types of skills, increased support personnel, revision to training programs and changes in maintenance concepts. These represent only a small sample of the types of changes that may be instigated by introducing a new weapon system into the Air Force inventory.

The objective of this study was the development of methods for defining the components of innovative technology and for measuring the effects of the incoming technology on Air Force human resources. The human resource parameters of concern include manpower (e.g., numbers, job types, skill levels) training considerations, and cost data. Earlier investigations established the feasibility of using human resources data in design trade studies and of determining and graphically depicting the array of trade-off options available before inception of hardware design (Askren and Korkan, 1971; Askren, Korkan, and Watts, 1973). The purpose of the study program reported herein was to identify or to develop a method for quantifying the effects of incoming technology on the Air Force human resources required to maintain or operate a system which incorporates those technological innovations.

APPROACH

A five-step approach was taken to study the problem:

1. Search and critical analysis of the recent literature to review the status of forecasting and assessing technology and of techniques for predicting the impact of technology on human resource parameters.
2. Develop Design Option Decision Trees (DODT) for Remotely Piloted Vehicle Systems and the Digital Avionics Information Systems.
3. Development of unique methods or synthesis of existing techniques to result in a new method for measuring the effects of technology on Air Force human resources.

4. Application of methods developed under the phase three effort.
5. Evaluation of the usefulness of the technique to system designers and planners together with an identification of the various processes by which system designers and planners could make use of the results.

RESULTS AND CONCLUSIONS

A method integrating the Design Option Decision Tree with a modification of the method of summated ratings was developed to permit quantification of specific human resource components at each of the design options represented in the DODT. Using judgmental data collected from an operational unit in the field, the method developed under this study effort was evaluated for utility. It was concluded that quantifying human resource components associated with hardware design options by means of a technique incorporating a DODT and a modification of the method of summated ratings is a feasible approach and will provide one methodological procedure for measuring the effects of advances in technology on human resources in Air Force weapon systems.

The possibility of other, more objectively based, procedures is recognized, but emergence of such a procedure appears likely to come only as a result of additional study and resolution of many current theoretical and methodological problems.

PREFACE

This study was initiated by the Advanced Systems Division, Air Force Human Resources Laboratory, Wright-Patterson Air Force Base, Ohio under Project 7907, "Conditions of Effective Training and Transfer," Dr. Ross Morgan, Project Scientist, and Work-Unit 79070007, "Determining Impact of New Technology on Air Force Human Resources," Duncan L. Dieterly, Major, USAF, Task Scientist. The research was performed by Systems Research Laboratories, Inc., (SRL), Dayton, Ohio, under Contract F33615-74-C-4019 with Dr. Norman R. Potter as Principal Investigator and Kenneth D. Korkan as Associate Principal Investigator.

The authors wish to acknowledge the guidance and support provided by Dr. William B. Askren, Kenneth W. Potempa and Noel Schwartz, Advanced Systems Division, in initial structuring of the research problem.

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Section I
INTRODUCTION

A series of DODT's were generated to reflect the design philosophy of remotely piloted vehicles. This set of DODT's has been derived from the more general Aerospace Vehicle Design DODT's generated on previous efforts for Air Force Human Resource Laboratory (AFHRL). As will be noted, the modifications required to the basic Aerospace Vehicle Design DODT plus the additions to the tailor it to RPV's proved to be extensive enough, resulting in a Remotely Piloted Vehicle Design Tree (SRL Dwg. No. 6810-02-2986). The four-sheet set of Airframe DODT's was also modified extensively to make it appropriate to RPV's (SRL Dwg No. 6810-02-2500, Sheets 1-4). The Reciprocating Engine Tree was modified considerably, but retained its original drawing (SRL Dwg. No. 6713-10-37-1275, Revision C). Two entirely new trees were also developed, which are unique to RPV technology, which consist of Launch Systems (SRL Dwg. No. 6810-02-2497) and Recovery Systems (SRL Dwg. No. 6810-02-2498).

The following list represents a compilation of the set of eighteen RPV DODT's and their status, i.e., title, drawing number, and whether new/minor modification/no change had been accomplished during the course of the study. A table of definitions (Section IV) of terms as they are used in this series of DODT's is intended as an aid to avoid any semantic ambiguities or misinterpretations.

Title	SRL Dwg. No.	Status
RPV Design	6810-02-2496	New
Launch Systems	6810-02-2497	New
Recovery Systems	6810-02-2498	New
Airframe	6810-02-2500 (Sheets 1-4)	New
Reciprocating Engine	6713-10-37-1275	Minor Modification
Jet Engine	6713-59-1695	No Change
Rocket Engine	6713-10-1277	No Change
Weapons Delivery	6713-53-1693 (Sheets 1-4)	No Change

Title	SRL Dwg. No.	Status
Radar System	6713-64-1945	No Change
Jet Engine-Assembly	6713-53-1691 (Sheets 1-2)	No Change
Jet Engine-Installation	6713-53-1696	No Change
Jet Engine Support System	6713-53-1692	No Change

Corroborative interviews on this series of trees were accomplished with many additional SRL personnel who have been involved in relevant aspects of unmanned flight vehicle design and fabrication. In addition, personnel representing the Aeronautical Systems Division (ASD) RPV Mission Analysis SPO and the Flight Dynamics Laboratory at Wright-Patterson AFB, Ohio, were also briefed to ascertain authenticity of the RPV DODT's.

The following are discussions of the approach and logic used in generating the specified new DODT's or DODT's that required modification. Discussions concerning the remaining DODT's used in this study may be found in previously generated letter reports and will not be included here.

Remotely Piloted Vehicle DODT (SRL Dwg. No. 6810-02-2496)

The Remotely Piloted Vehicle design DODT begins with a consideration of system objectives. For example, what mission the vehicle is intended to perform, how much it is allowed to cost, how long a service life it must have, are considered system objectives which could dictate later decisions and thus must be clearly laid out if available prior to proceeding with the design. Once system objectives are defined, several levels of decisions define the specific mission or missions for which the RPV is being designed. Following mission definition, appropriate steps to choose the basic configuration of the vehicle are defined. Configuration decisions are followed by a set of performance parameter decisions. The last major branch on this decision tree delineates the major hardware classifications which must be simultaneously considered as the RPV design becomes more specific. Many of these hardware classifications are the subject of more detailed trees, as indicated by the drawing numbers which are referenced.

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As a note of interest, the Core Avionics or Information Processing System (SRL Dwg. No. 6810-02-2499), is referred to on the RPV DODT. This is a series of trees that have been developed concurrently as another project task relative to the Digital Avionics Information System (DAIS). It is only one of several possible Core Avionic systems which could be included in an RPV design, and is mentioned here to show the potential interrelation of DAIS with RPV's.

Launch Systems DODT (SRL Dwg. No. 6810-02-2497)

The two areas which had not been previously treated in the DODT format are launch and recovery systems. Each of these was developed into a separate decision tree. Taking launch systems first, the decision as to whether air or ground launch is to be used would frequently be dictated by mission requirements or the operational scenario to be employed. For these reasons, the air/ground launch decision is treated first. As noted, however, a group of considerations must be immediately weighed against requirements of the other vehicle design areas and iterated until a mutually acceptable set of configuration options are arrived at. Although these component locations and performance characteristics are important to many design areas, they are especially crucial to the design of a launch system and are thus included here. Special note should be made of the inclusion of logistics support requirements. These are not considered in other trees and constitute a break in format to the extent that they are not really representative of decisions being made in the design. However, the impact of logistics support on launch systems is considerable, and is included as a reminder that such items cannot be overlooked in the design.

Recovery Systems DODT (SRL Dwg. No. 6810-02-2498)

The recovery system DODT is governed by many of the same constraints as the launch system, as indicated by the similarities on both DODT's. This is especially true of logistics support, which can easily dominate all other factors which might be brought to bear on the recovery system design. Note that the air/ground decision in this case is later in the network. While the

types of launch system are considered early in the design, this is not necessarily true of the recovery system. That is, the mission will obviously not be carried out if the launch is inadequate; thus, the recovery becomes a subordinate decision. However, as a limiting case for the sake of illustration, the RPV is not recovered and becomes expendable.

Airframe DODT (SRL Dwg. No. 6810-02-2500/Sheets 1-4)

The Airframe DODT was modified to reflect those added decisions which are peculiar to an unmanned vehicle and to remove those which are apropos only to manned vehicles. In addition, in some cases the decision network was restructured since the flow of decisions often proceeds in a slightly different manner when an RPV is the objective. Sheets 1 and 2 were almost entirely concerned with the above described sorting out and reorganizing. Sheet 3 (Takeoff and Landing Systems) was modified considerably, which is indicative that such RPV systems encompass a broader spectrum of available options than do the landing gear systems of manned aircraft. Sheet 4 (Airframe/Propulsion Integration) was modified to fit directly into an interface position between the Airframe and Propulsion headings listed at the conclusion of the RPV Design Tree. A major modification was the removal of engine controls, environmental systems, cockpit controls and displays, and some safety decisions which are not required in an RPV.

Section II

SUMMARY

The DODT technique was used to develop a set of trees for an RPV concept. The set of trees developed reflects the insights of both the contractor and other engineers working in the RPV area. The trees provide a starting point for the conceptualization of a new RPV design. The set of drawings establish a linear decision process. In addition to the major purpose of the DODT's for this research project, is a tool for assisting in quantifying human resource requirements of various technologies, they may be used for a series of management actions. The initial set may be used for several types of management processes, for example:

1. As a guide to assist overall program management. The DODT could allow the program management p sonnel to monitor or track the design activities for the project. The DODT could: (a) show the sequence and priority of the design decisions to be made; (b) show the interrelationships of decisions, which would identify the need for interdisciplinary efforts; (c) provide an indication of the t al number of decisions or trade-offs that would be required during the course of the program; (d) provide a basis for allocating design decision making to appropriate levels of the organization, such as program director, chief engineer, detailers, etc.; and (e) provide an historical record of the design trade-off decisions that occurred during development of the system--this could provide a basis for explanation (or defense) of the engineering effort performed.
2. As a method of systematic documentation of alternatives considered and rejected at decision points, together with a cataloging of reasons for accepting or rejecting each.
3. As a teaching/training device for indoctrinating newly assigned personnel on the specifics of the system.
4. As a vehicle for permitting an engineer in any particular system discipline to be cognizant of the impingement of other disciplines on his system inputs and of the specific nature and effect of these interactions.
5. As a means for deriving a measure of the state-of-the-art uniqueness of the final design product. This could be obtained, for example,

by identifying the proportion of the decision point options selected which are traditional design concepts versus the proportion of options selected which are new, state-of-the-art approaches.

6. As a tool for redesign. If a product is judged to be unsatisfactory against certain standards in its present configuration, a reanalysis of the DODT could detect the decision points and options involved. This could lead to a selection of a new set of design options, leading to a new product which better meets the standards.
7. As a dramatic aid to explanation of the system under development to the various levels of presentation required--e.g., Command presentations or Congressional testimonies.
8. As a procedure for assuring that viable alternatives are not ignored due to preexisting baises or failure to be aware of the existence of such options.

Although the RPV set of trees was not selected in this project for much detailed research the impact of human resource parameters could be roughly approximated using the DODTs as the decision base. The preparation of this set of DODTs is the first step in the exploration of the RPV design process and further research would be required to provide more specific results.

Section III

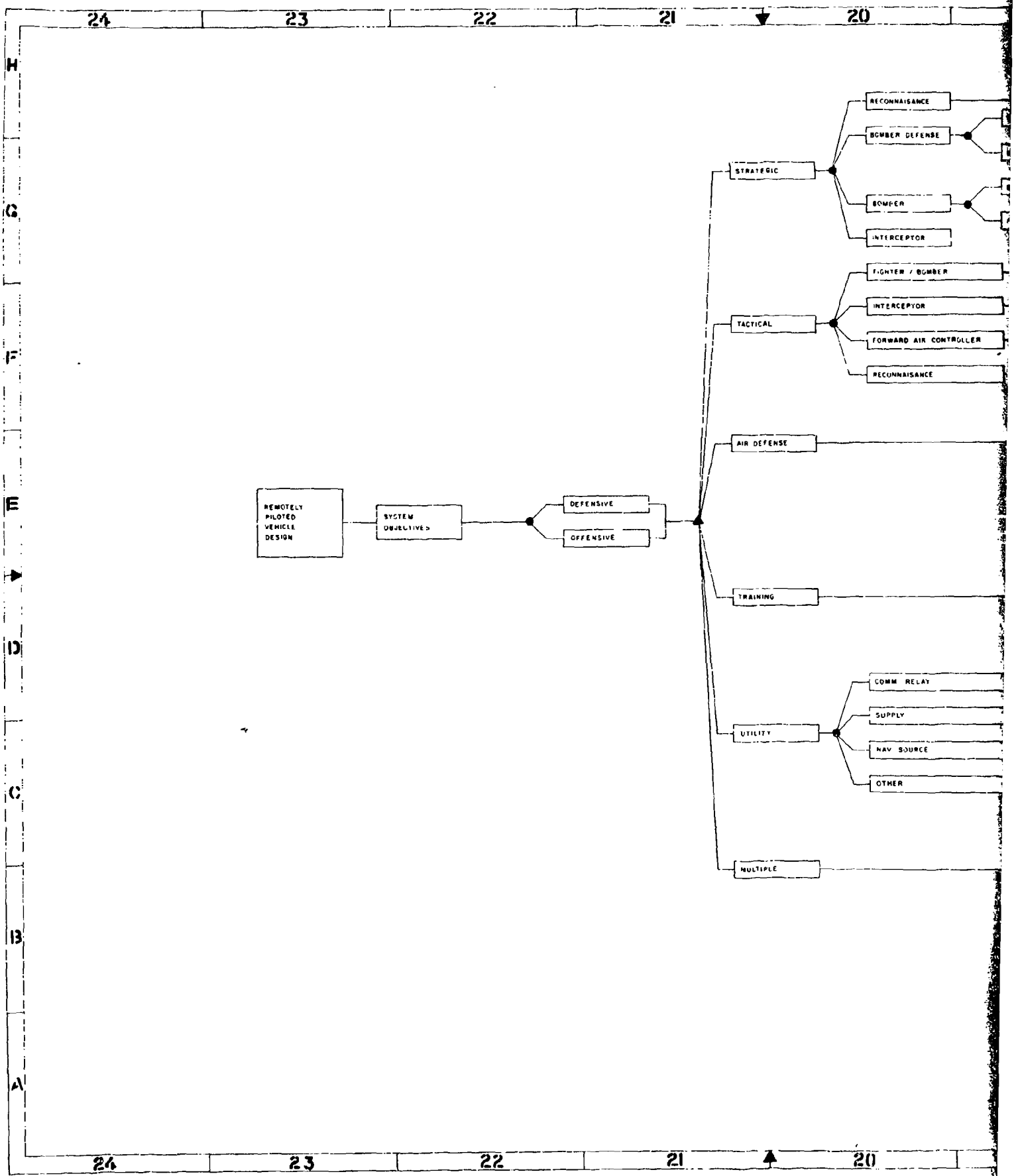
REMOTELY PILOTED VEHICLES
DESIGN OPTION DECISION TREES

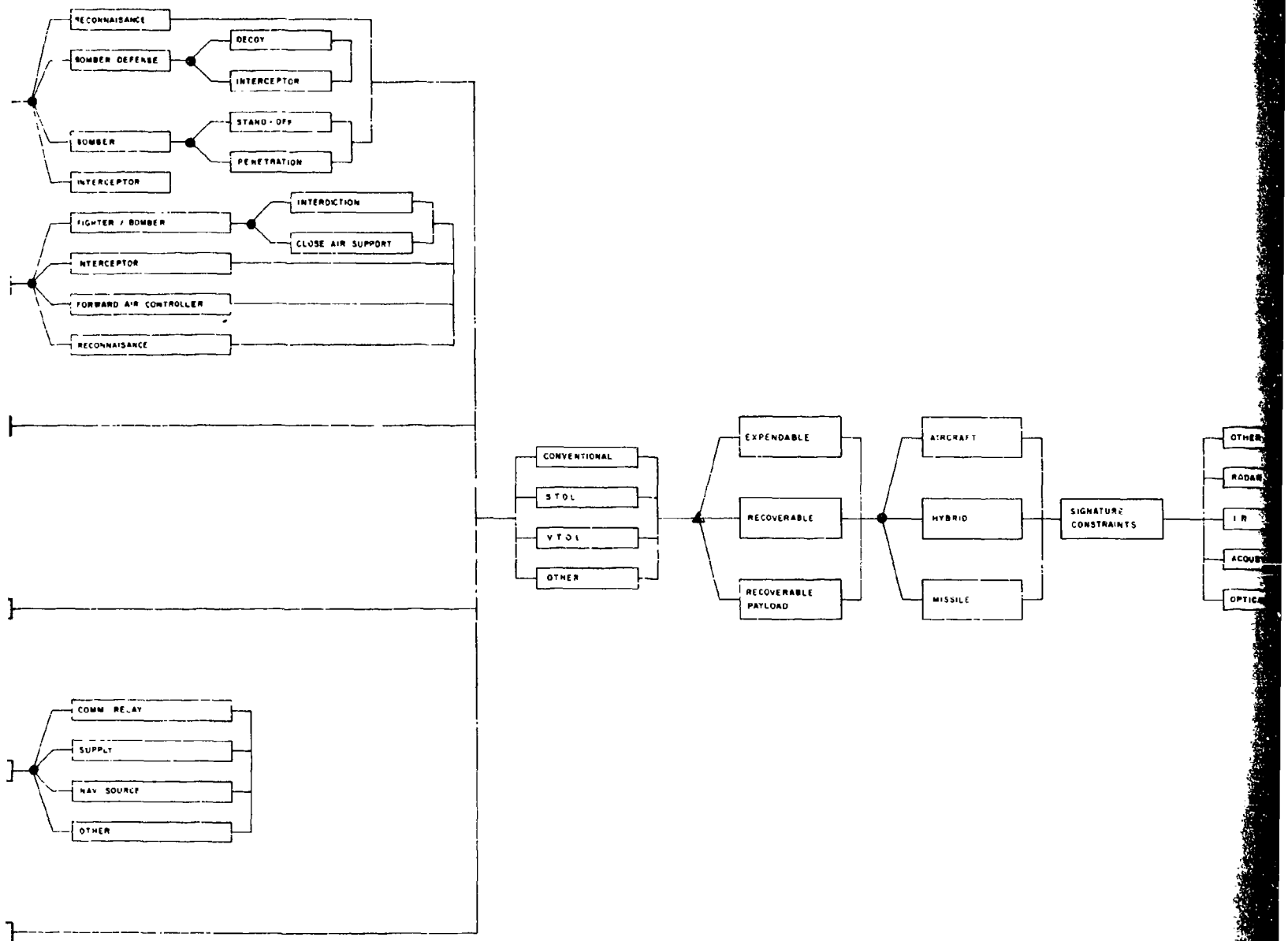
Section III contains the following Design Option Decision Trees:

Title	SRL Dwg. No.
RPV Design	6810-02-2496
Launch Systems	6810-02-2497
Recovery Systems	6810-02-2498
Airframe	6810-02-2500 (Sheets 1-4)
Reciprocating Engine	6713-10-37-1275
Jet Engine	6713-59-1695
Rocket Engine	6713-10-1277
Weapons Delivery	6713-53-1693 (Sheets 1-3)
Radar System	6713-64-1945
Jet Engine-Assembly	6713-53-1691 (Sheets 1-2)
Jet Engine-Installation	6713-53-1696
Jet Engine Support System	6713-53-1692

The definitions contained here are for the following DODT's:

Remotely Piloted Vehicle DODT (Dwg. No. 6810-02-2496)
Launch Systems DODT (Dwg. No. 6810-02-2497)
Recovery Systems DODT (Dwg. No. 6810-02-2498)
Airframe DODT (Dwg. No. 6810-02-2500/Sheets 1-4)


24
23
22
21
20
H
G
F
E
D
C
B
A
REMOTELY PILOTED VEHICLE DESIGN
SYSTEM OBJECTIVES
DEFENSIVE
OFFENSIVE
STRATEGIC
RECONNAISANCE
BOMBER DEFENSE
BOMBER
INTERCEPTOR
TACTICAL
FIGHTER / BOMBER
INTERCEPYOR
FORWARD AIR CONTROLLER
RECONNAISANCE
AIR DEFENSE
TRAINING
UTILITY
COMM RELAY
SUPPLY
NAV SOURCE
OTHER
NULTIPLE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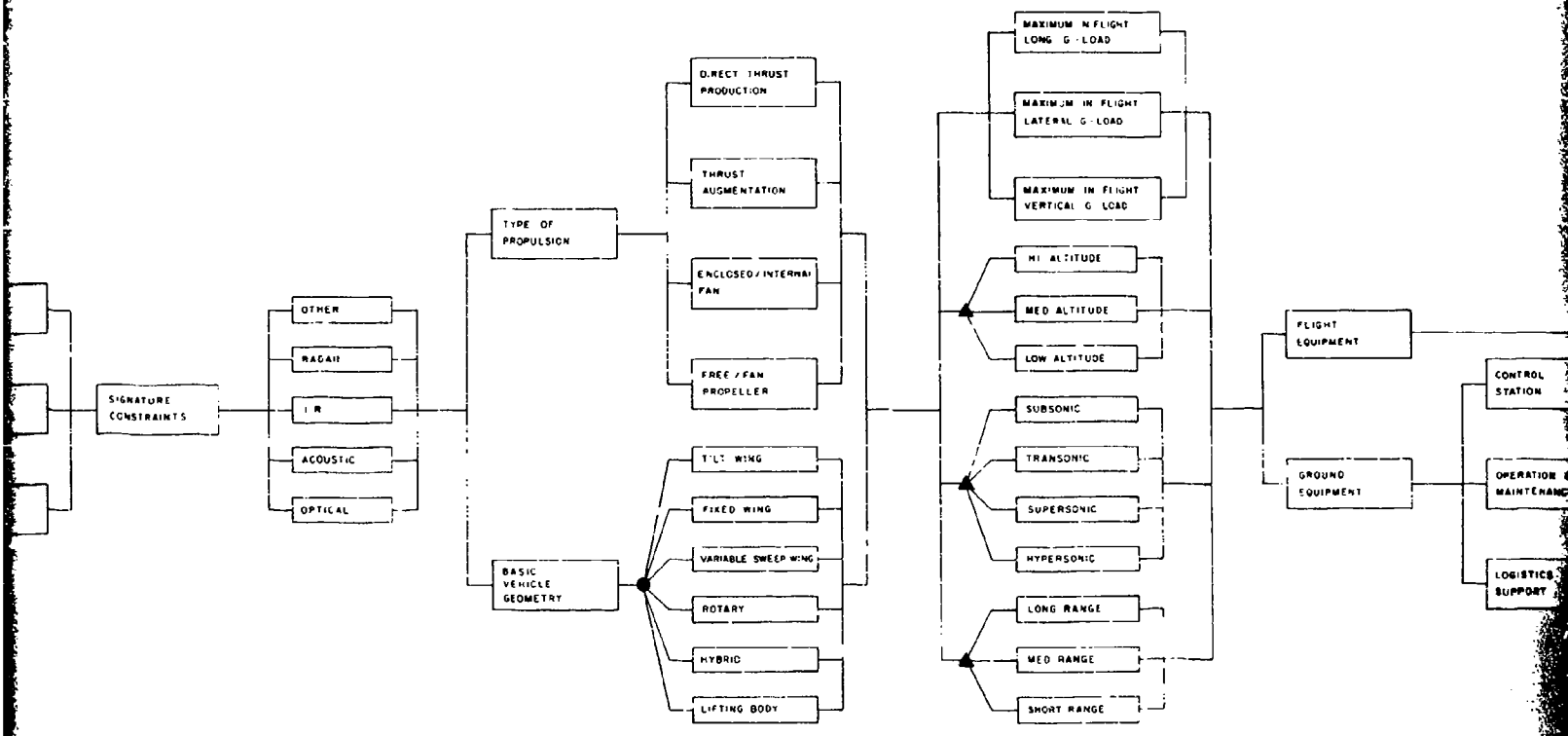
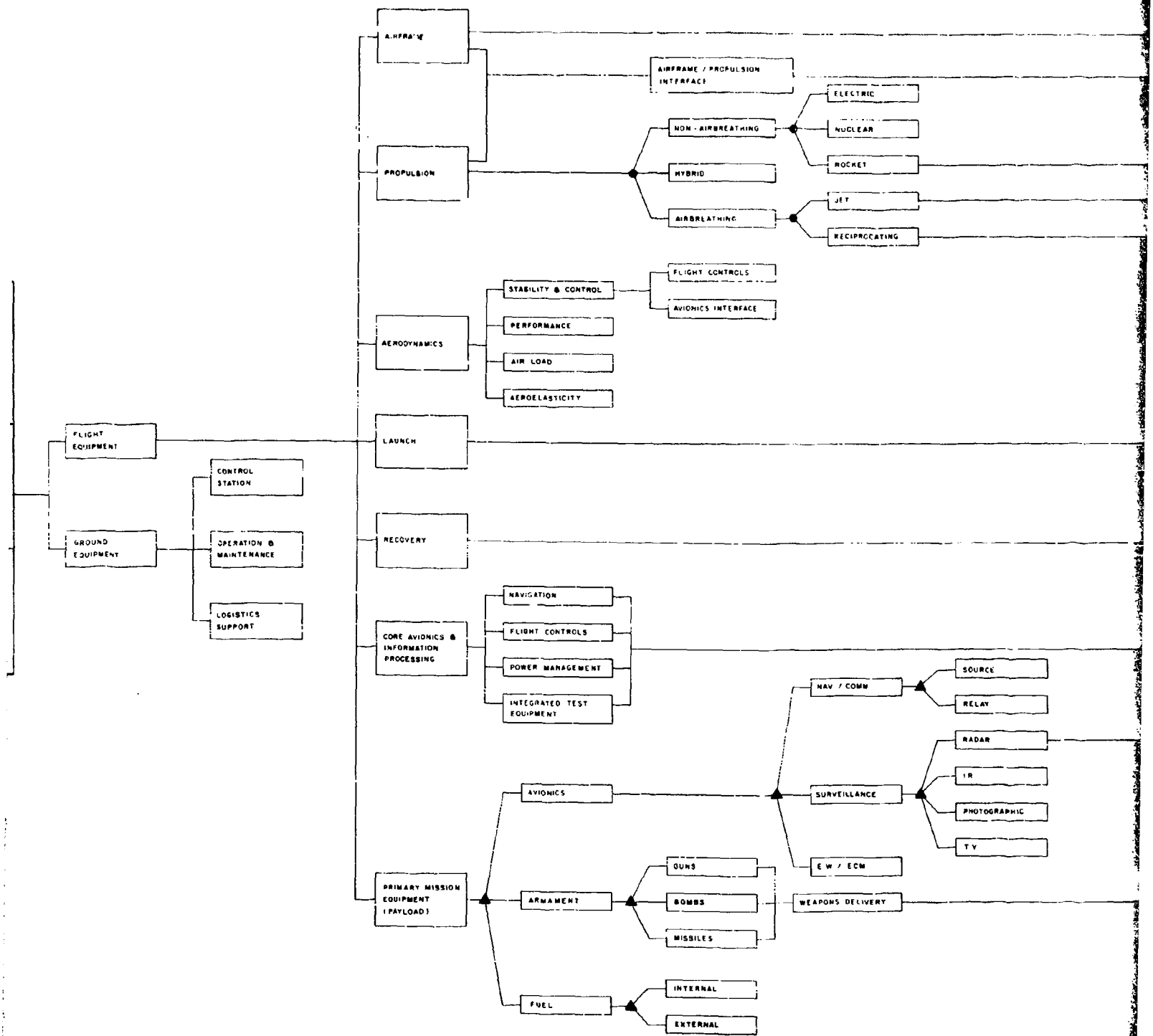
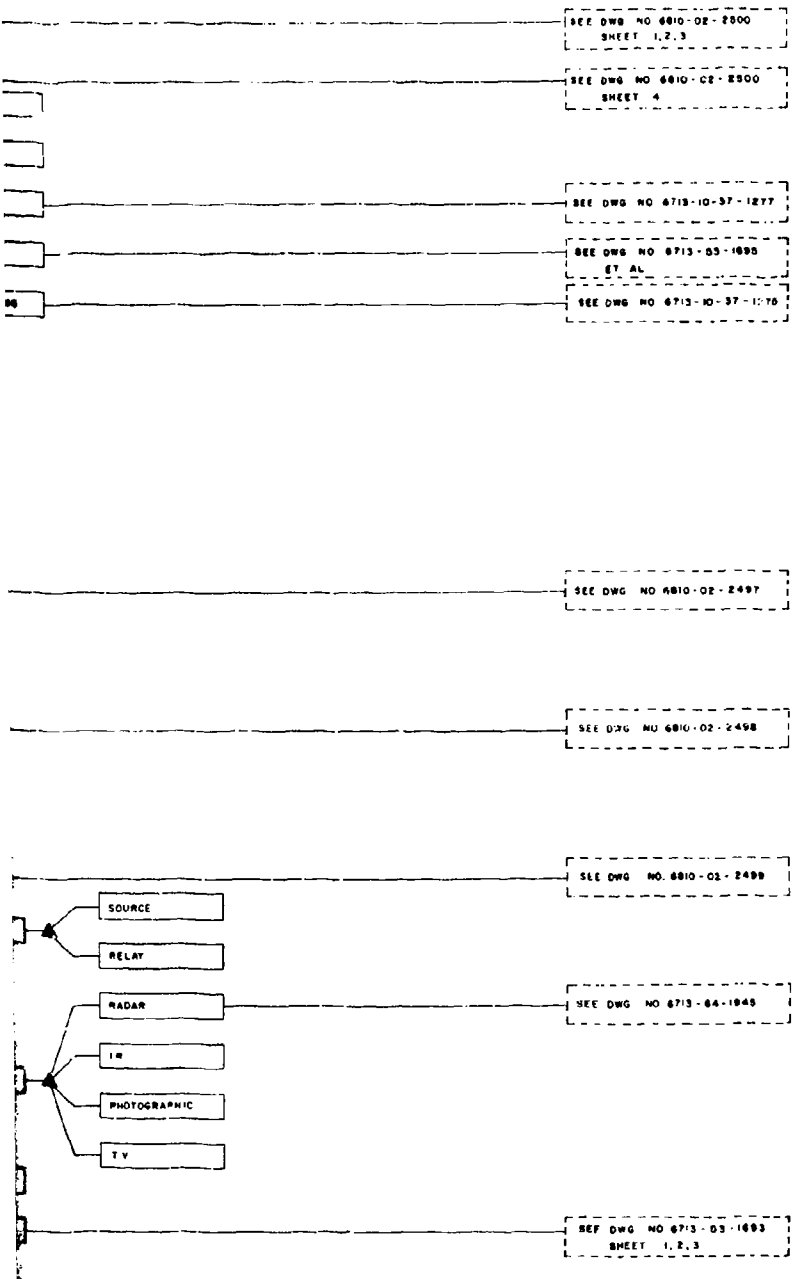
BOMBER DEFENSE
DECOY
INTERCEPTOR
BOMBER
STAND - OFF
PENETRATION
INTERCEPTOR
FIGHTER / BOMBER
INTERDICTION
CLOSE AIR SUPPORT
INTERCEPTOR
FORWARD AIR CONTROLLER
RECONNAISANCE
COMM RELAY
SUPPLY
NAV SOURCE
OTHER
CONVENTIONAL
STOL
VTOL
OTHER
EXPENDABLE
RECOVERABLE
RECOVERABLE PAYLOAD
AIRCRAFT
HYBRID
MISSILE
SIGNATURE CONSTRAINTS
OTHER
RADAR
I R
ACOUS
OPTIC


SIGNATURE CONSTRAINTS
OTHER
RADAR
I R
ACOUSTIC
OPTICAL
TYPE OF PROPULSION
BASIC VEHICLE GEOMETRY
DIRECT THRUST PRODUCTION
THRUST AUGMENTATION
ENCLOSED / INTERNAL FAN
FREE / FAN PROPELLER
TILT WING
FIXED WING
VARIABLE SWEEP WING
ROTARY
HYBRID
LIFTING BODY
MAXIMUM IN FLIGHT LONG G - LOAD
MAXIMUM IN FLIGHT LATERAL G - LOAD
MAXIMUM IN FLIGHT VERTICAL G LOAD
HI ALTITUDE
MED ALTITUDE
LOW ALTITUDE
SUBSONIC
TRANSONIC
SUPERSONIC
HYPERSONIC
LONG RANGE
MED RANGE
SHORT RANGE
FLIGHT EQUIPMENT
GROUND EQUIPMENT
CONTROL STATION
OPERATION &
LOGISTICS SUPPORT


AIRFRAME
AIRFRAME / PROPULSION INTERFACE
PROPULSION
NON - AIRBREATHING
ELECTRIC
NUCLEAR
ROCKET
HYBRID
AIRBREATHING
JET
RECIPROCATING
AERODYNAMICS
STABILITY & CONTROL
FLIGHT CONTROLS
AVIONICS INTERFACE
PERFORMANCE
AIR LOAD
AEROELASTICITY
FLIGHT EQUIPMENT
LAUNCH
CONTROL STATION
GROUND EQUIPMENT
OPERATION & MAINTENANCE
LOGISTICS SUPPORT
RECOVERY
CORE AVIONICS & INFORMATION PROCESSING
NAVIGATION
FLIGHT CONTROLS
POWER MANAGEMENT
INTEGRATED TEST EQUIPMENT
NAV / COMM
SOURCE
RELAY
RADAR
IR
PHOTOGRAPHIC
TV
AVIONICS
SURVEILLANCE
E W / ECM
PRIMARY MISSION EQUIPMENT (PAYLOAD)
GUNS
ARMAMENT
BOMBS
MISSILES
WEAPONS DELIVERY
FUEL
INTERNAL
EXTERNAL

4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SEE DWG NO 6810-02-2497
SEE DWG NO 6810-02-2498
SEE DWG NO. 6810-02-2499
SOURCE
RELAY
RADAR
IR
PHOTOGRAPHIC
TV
SEE DWG NO 6713-64-1945
SEE DWG NO 6713-03-1693 SHEET 1,2,3

SEE DWG NO 6810-02-2500
SHEET 1,2,3

SEE DWG NO 6810-02-2500
SHEET 4

SEE DWG NO 6713-10-37-1277

SEE DWG NO 6713-63-1695
ET AL

SEE DWG NO 6713-10-37-1278

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SEE DWG NO 6810-02-2498

SEE DWG NO. 6810-02-2499

SEE DWG NO 6713-64-1945

SEE DWG NO 6713-53-1693
SHEET 1,2,3

APPROVED			
CHECKED			
DRAWN	HARRIS	4/25/78	
CONTRACT NO			
SRL PROJECT APPROVAL			
SRMT ACTIVITY APPROVAL			

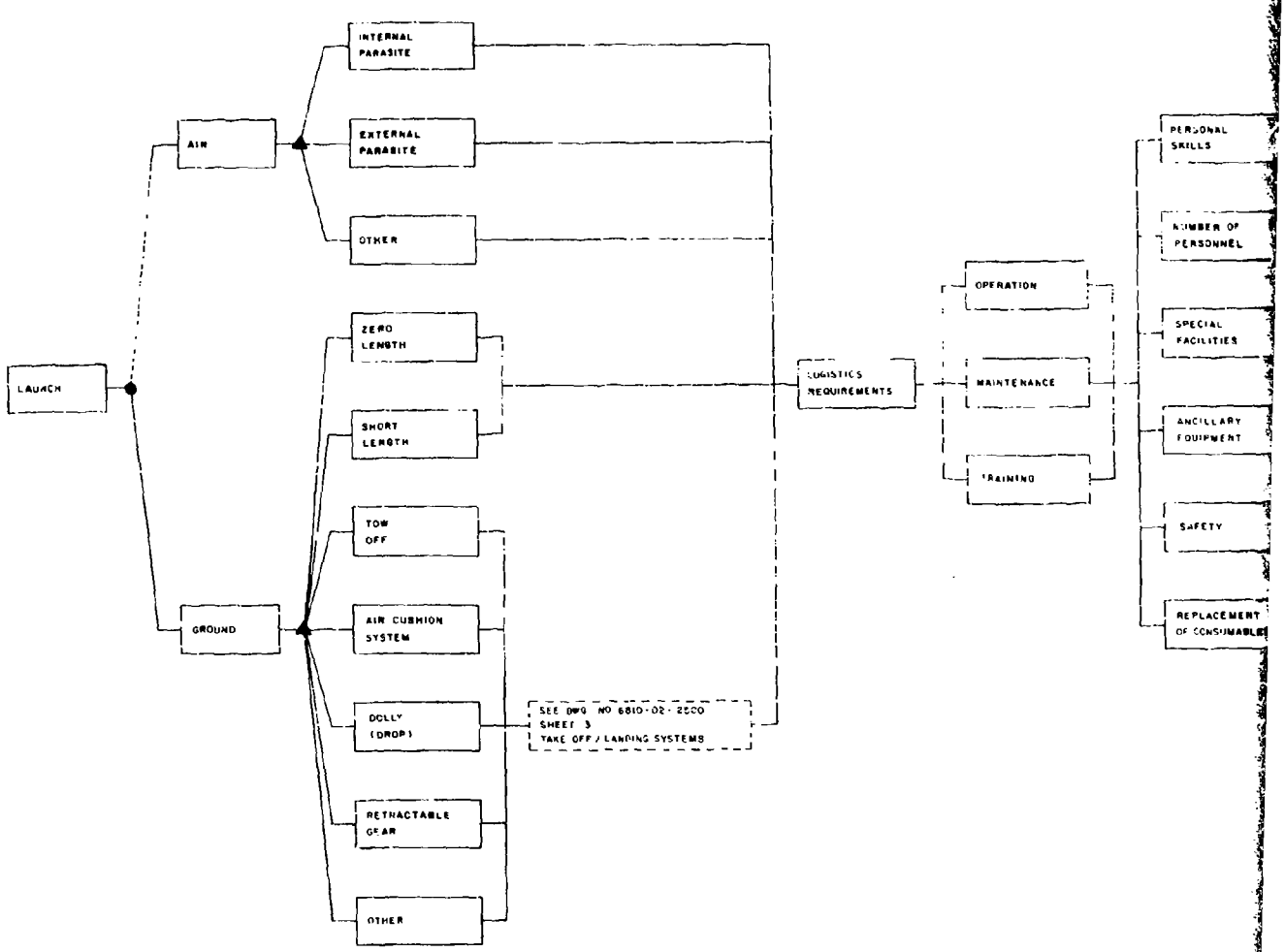
SYSTEMS RESEARCH LABORATORIES INC

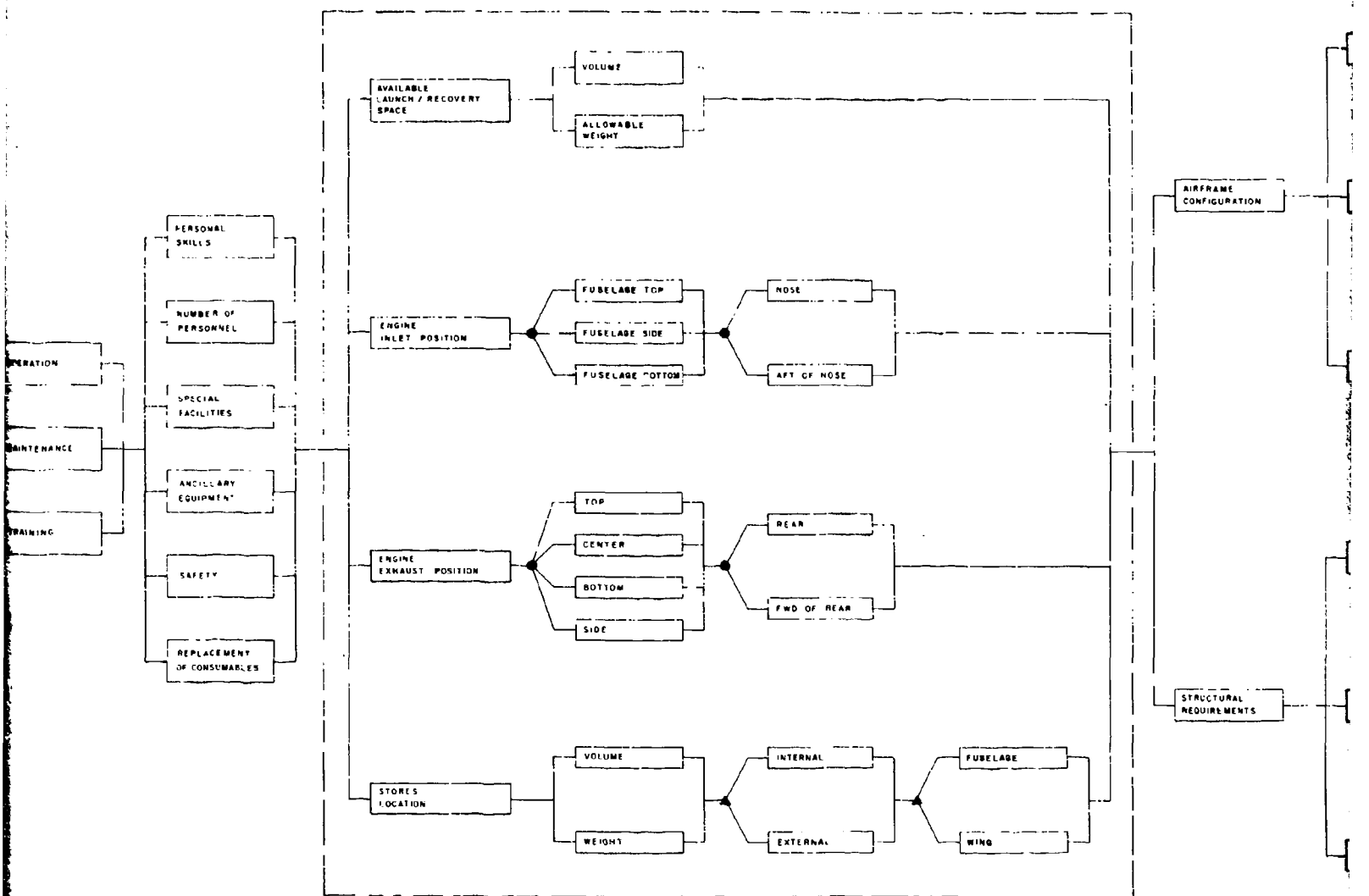
DECISION TREE
REMOTELY PILOTED
VEHICLE DESIGN

SIZE	CODE IDENT NO	DRAWING NO
J	14590	6810-02-2496

SCALE

SHEET 1 OF 1


LAUNCH
AIR
GROUND
INTERNAL PARASITE
EXTERNAL PARASITE
OTHER
ZERO LENGTH
SHORT LENGTH
TOW OFF
AIR CUSHION SYSTEM
DOLLY (DROP)
RETRACTABLE GEAR
OTHER
SEE DWG NO 6810-02-2000 SHEET 3 TAKE OFF / LANDING SYSTEMS
LOGISTICS REQUIREMENTS
OPERATION
MAINTENANCE
TRAINING
PERSONAL SKILLS
NUMBER OF PERSONNEL
SPECIAL FACILITIES
ANCILLARY EQUIPMENT
SAFETY
REPLACEMENT OF CONSUMABLES



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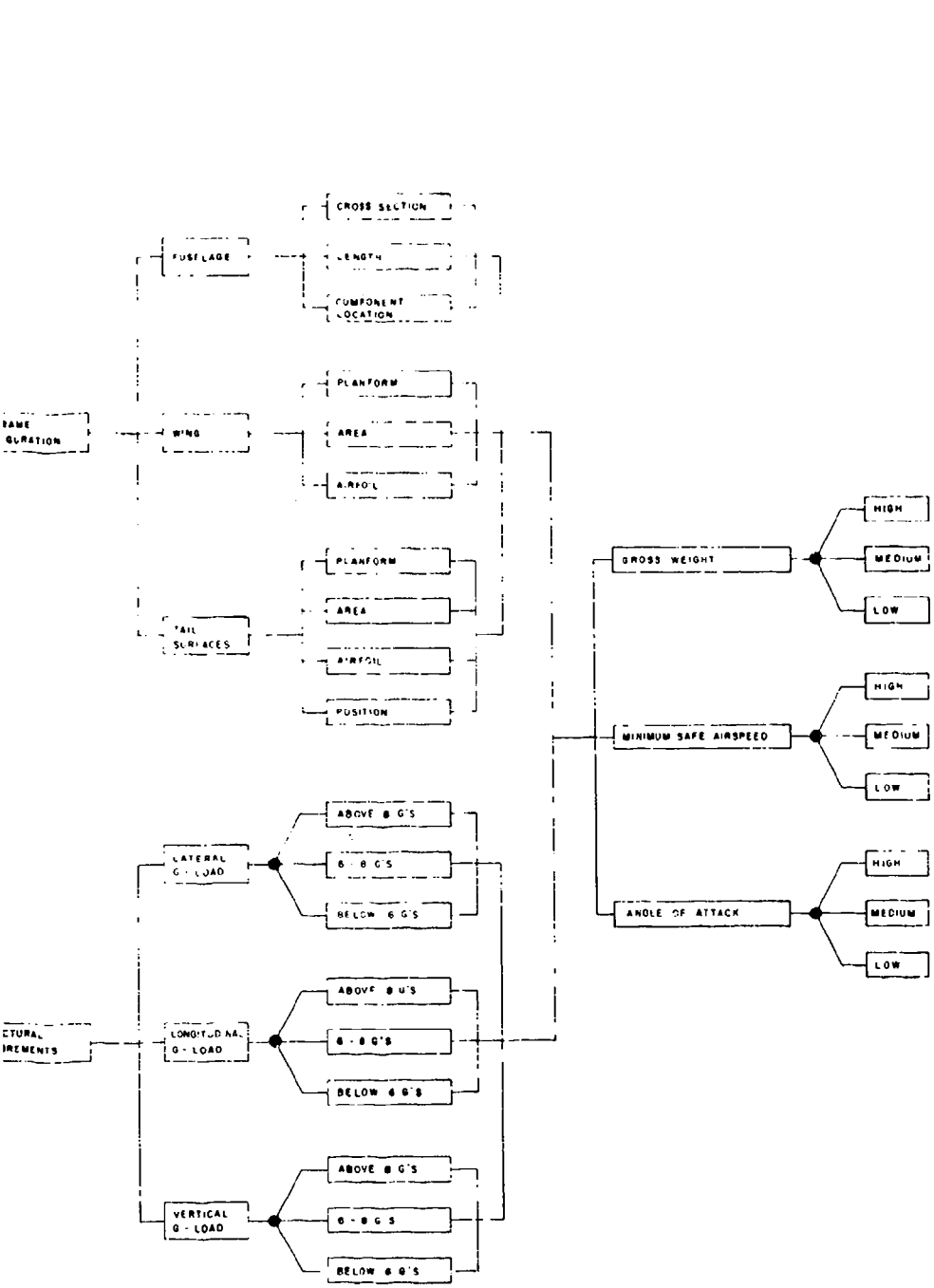
CROSS SECTION
FUSELAGE
LENGTH
COMPONENT LOCATION
PLANFORM
WING
AREA
AIRFOIL
PLANFORM
AREA
TAIL SURFACES
AIRFOIL
POSITION
ABOVE 8 G'S
LATERAL G - LOAD
6 - 8 G'S
BELOW 6 G'S
ABOVE 8 G'S
LONGITUDINAL G - LOAD
6 - 8 G'S
BELOW 6 G'S
ABOVE 8 G'S
VERTICAL G - LOAD
6 - 8 G'S
BELOW 6 G'S
GROSS WEIGHT
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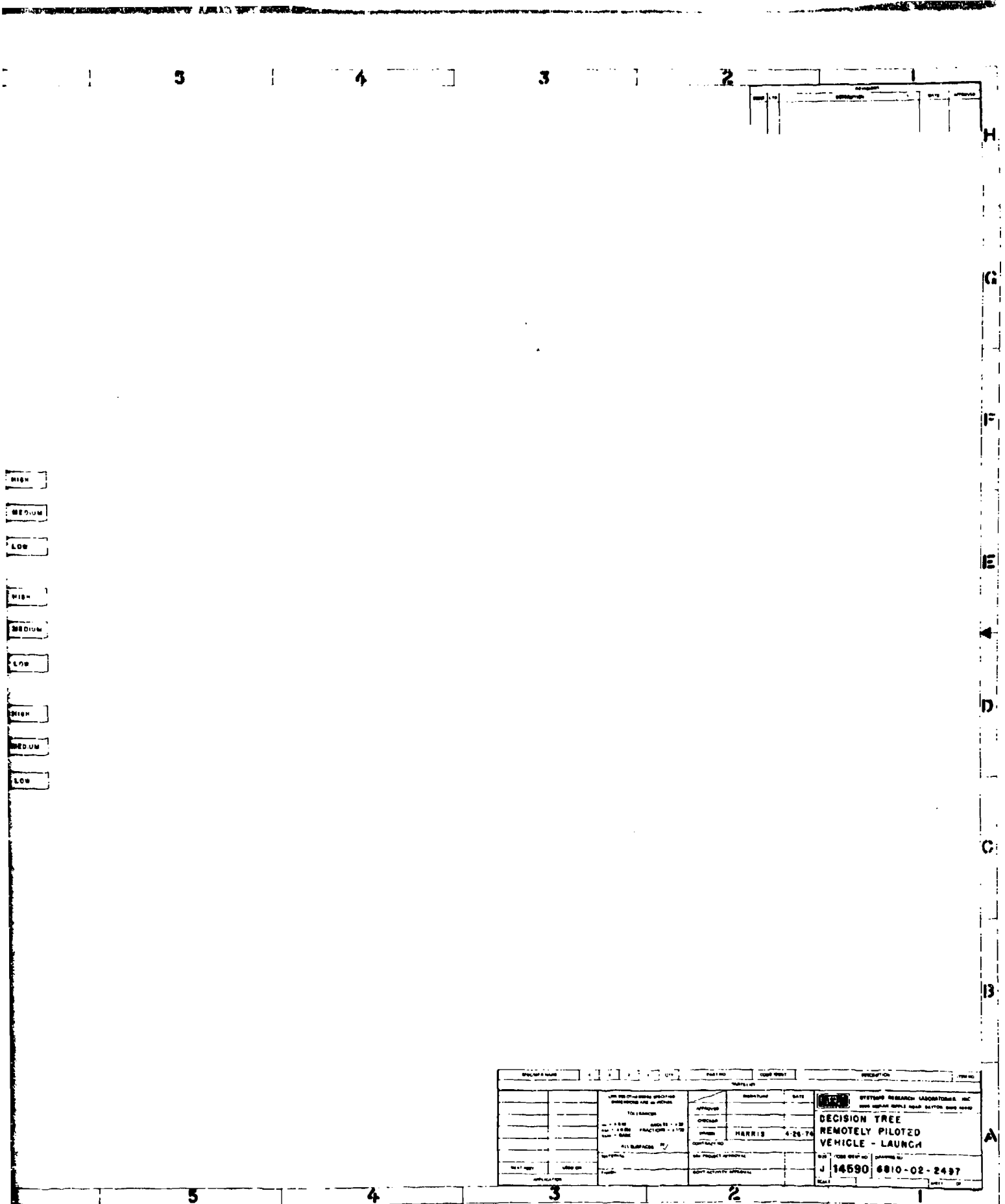
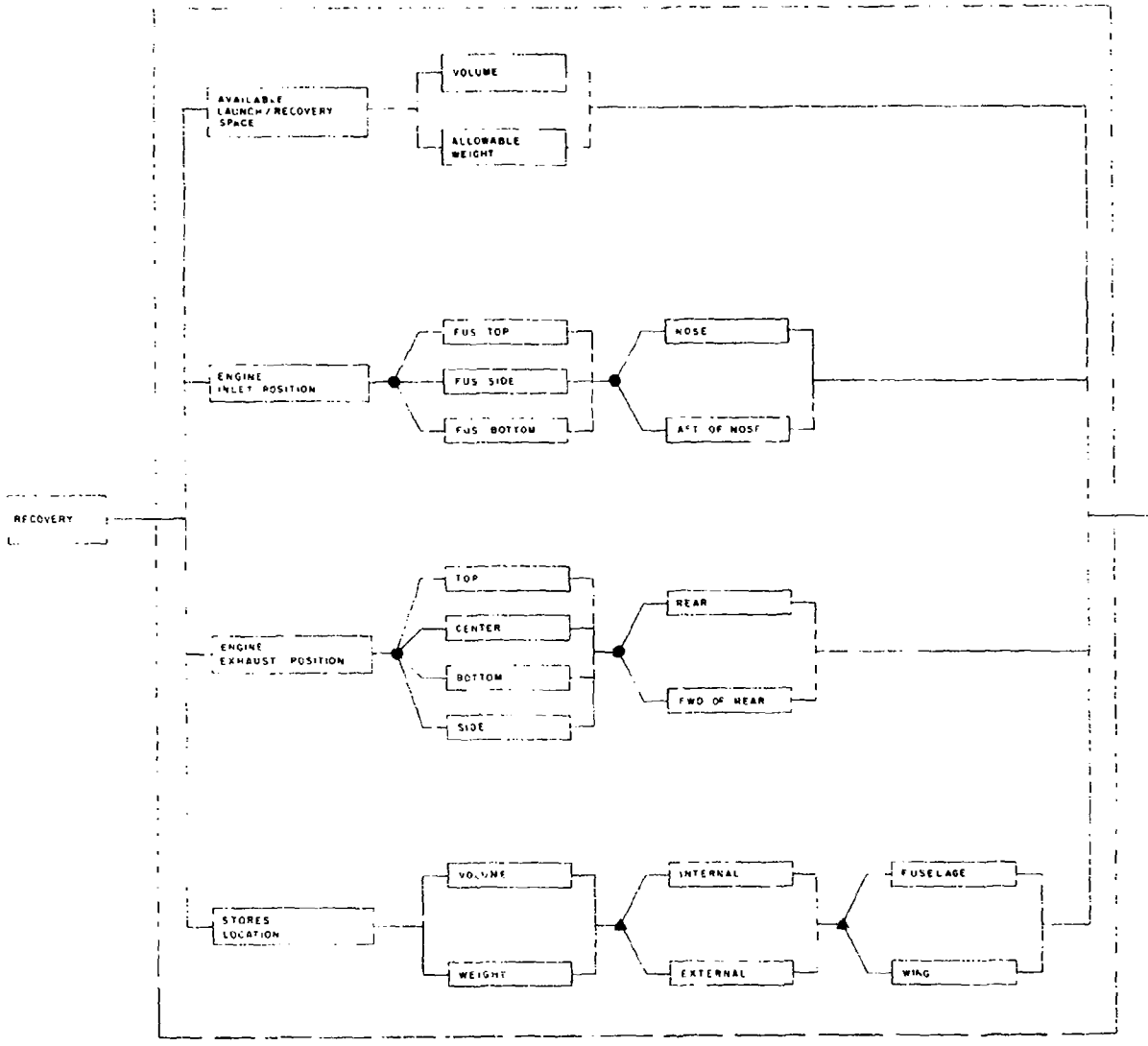
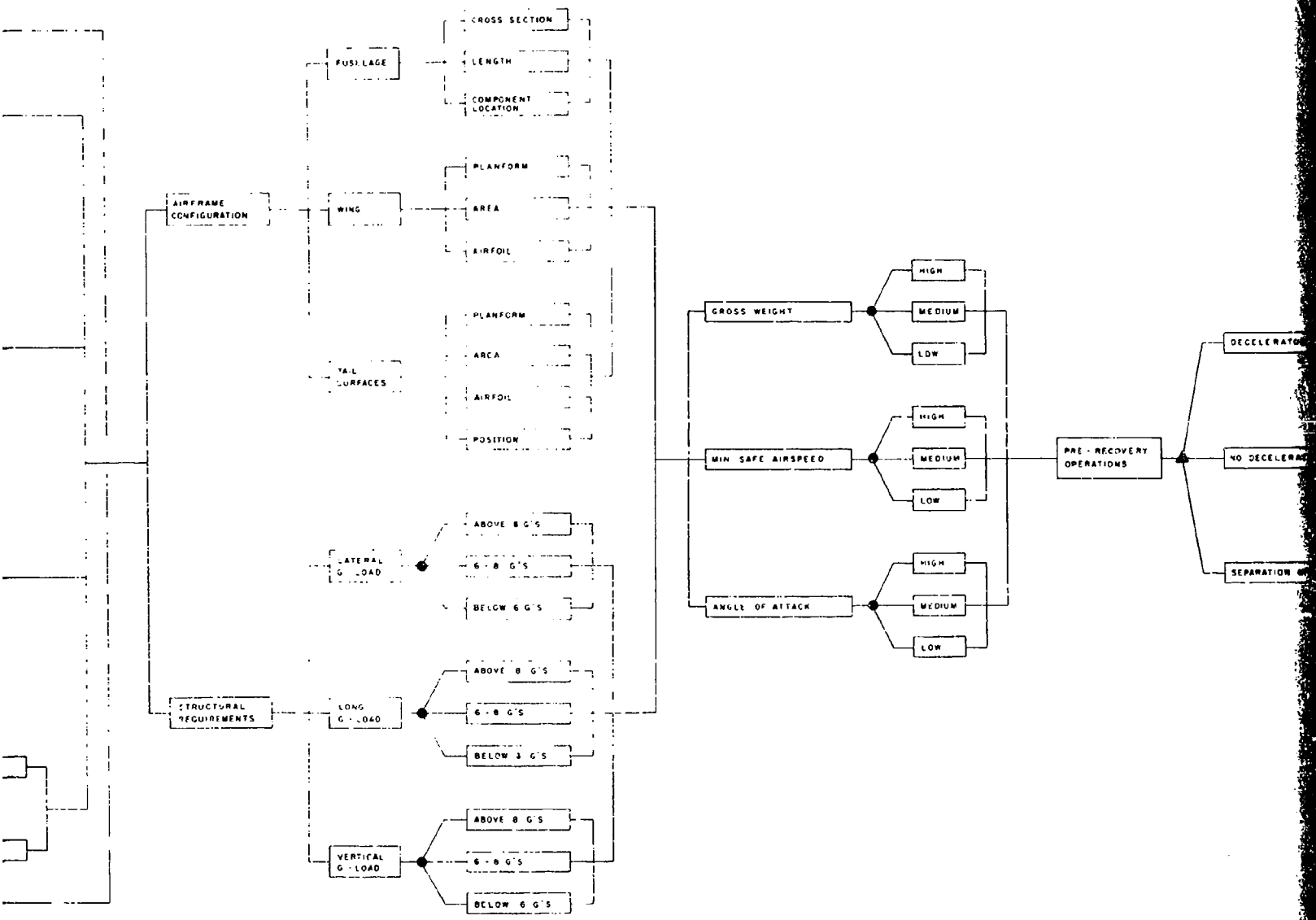
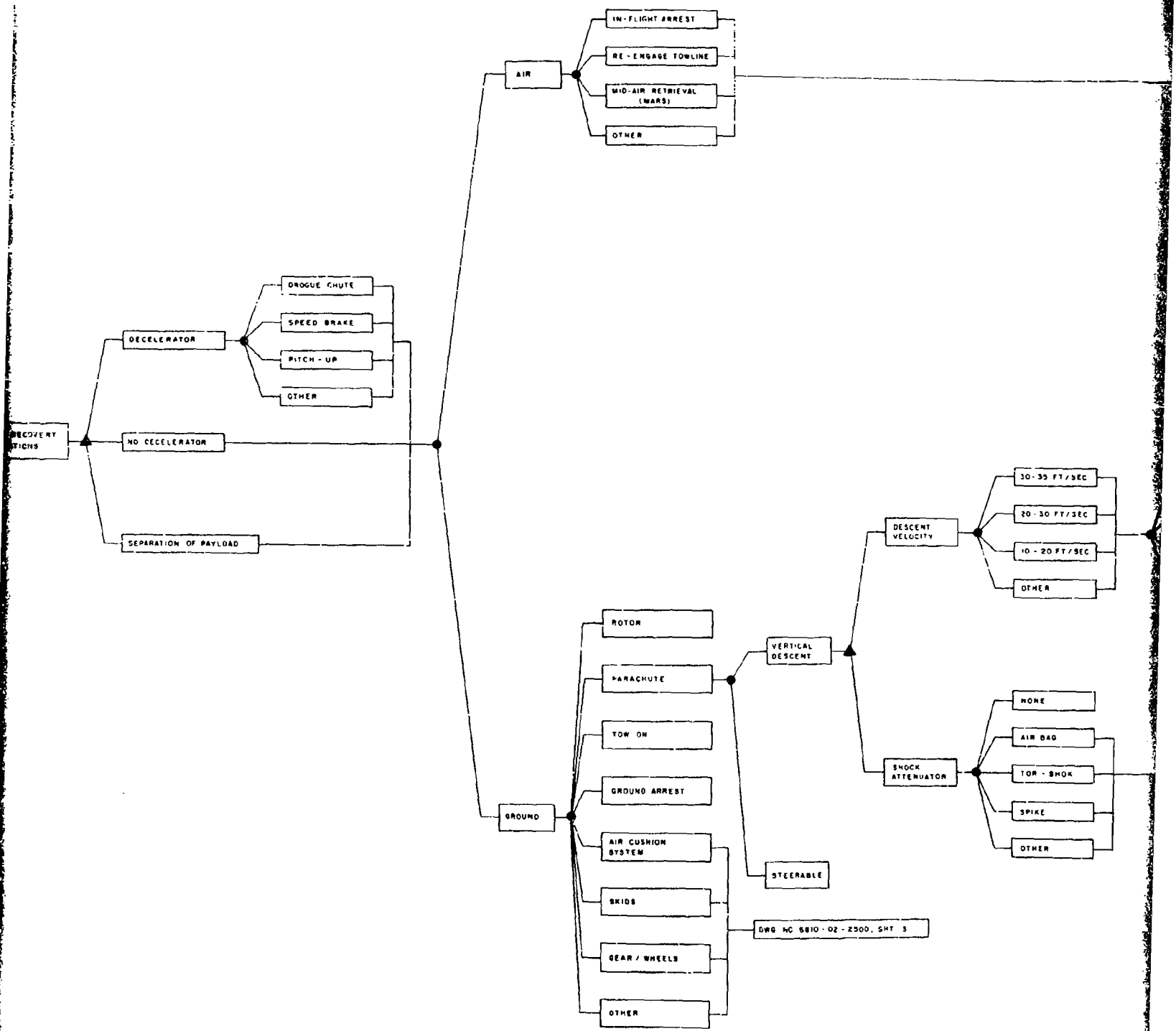
MEDIUM
LOW
MINIMUM SAFE AIRSPEED
HIGH
MEDIUM
LOW
ANGLE OF ATTACK
HIGH
MEDIUM
LOW

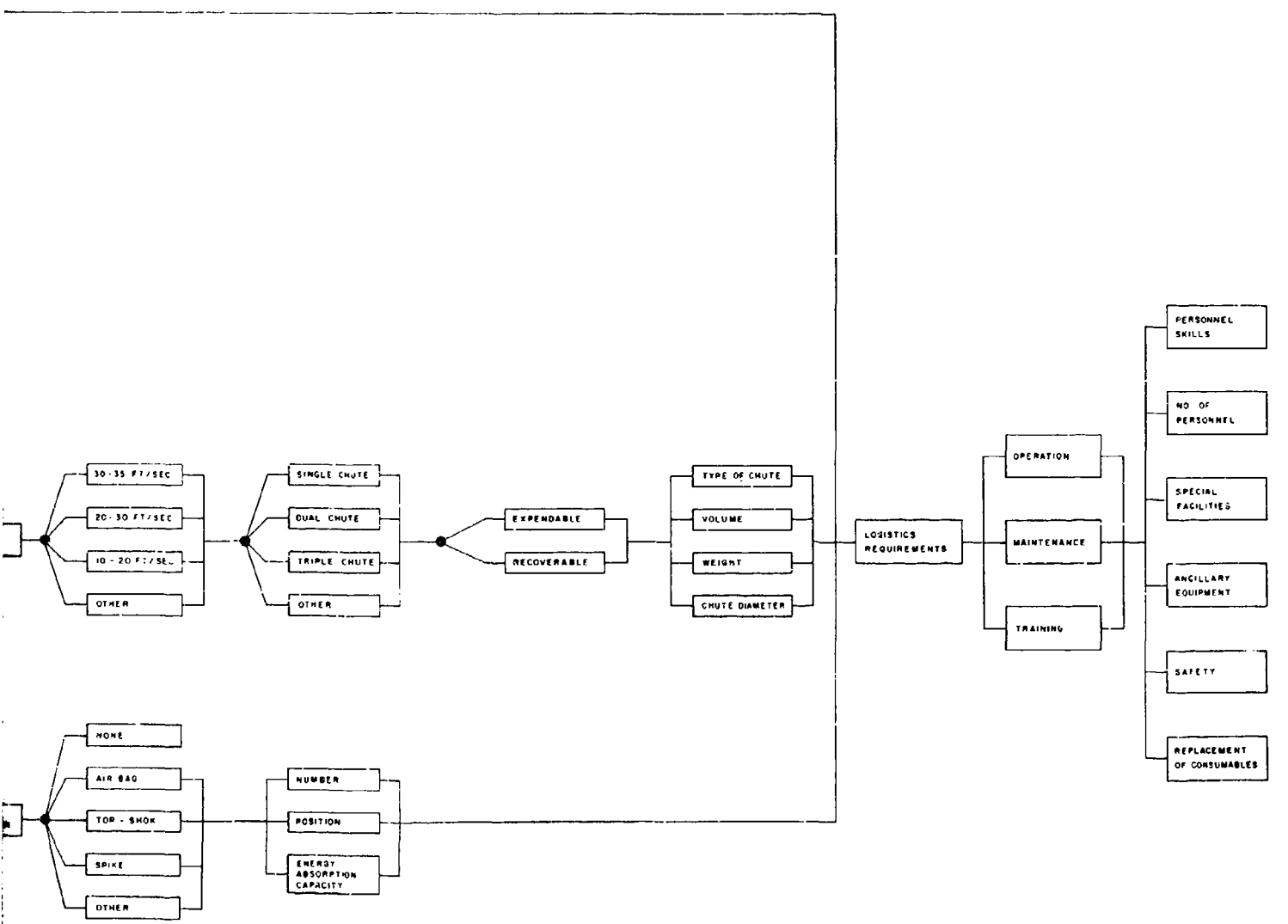

DECISION TREE
REMOTELY PILOTED
VEHICLE - LAUNCH
J 14590 6810-02-2497
HARRIS 4-26-74



DASHED BOX INDICATES PRELIMINARY SPECIFICATIONS SET OUT BY OTHER DESIGN AREAS, WHICH MUST BE JUDGED ACCEPTABLE OR UNACCEPTABLE.


AIRFRAME CONFIGURATION
FUSELAGE
CROSS SECTION
LENGTH
COMPONENT LOCATION
WING
PLANFORM
AREA
AIRFOIL
TAIL SURFACES
PLANFORM
AREA
AIRFOIL
POSITION
STRUCTURAL REQUIREMENTS
LATERAL G - LOAD
ABOVE 8 G'S
6 - 8 G'S
BELOW 6 G'S
LONG G - LOAD
ABOVE 8 G'S
6 - 8 G'S
BELOW 3 G'S
VERTICAL G - LOAD
ABOVE 8 G'S
6 - 8 G'S
BELOW 6 G'S
GROSS WEIGHT
HIGH
MEDIUM
LOW
MIN SAFE AIRSPEED
HIGH
MEDIUM
LOW
ANGLE OF ATTACK
HIGH
MEDIUM
LOW
PRE - RECOVERY OPERATIONS
DECELERATO
NO DECELERA
SEPARATION

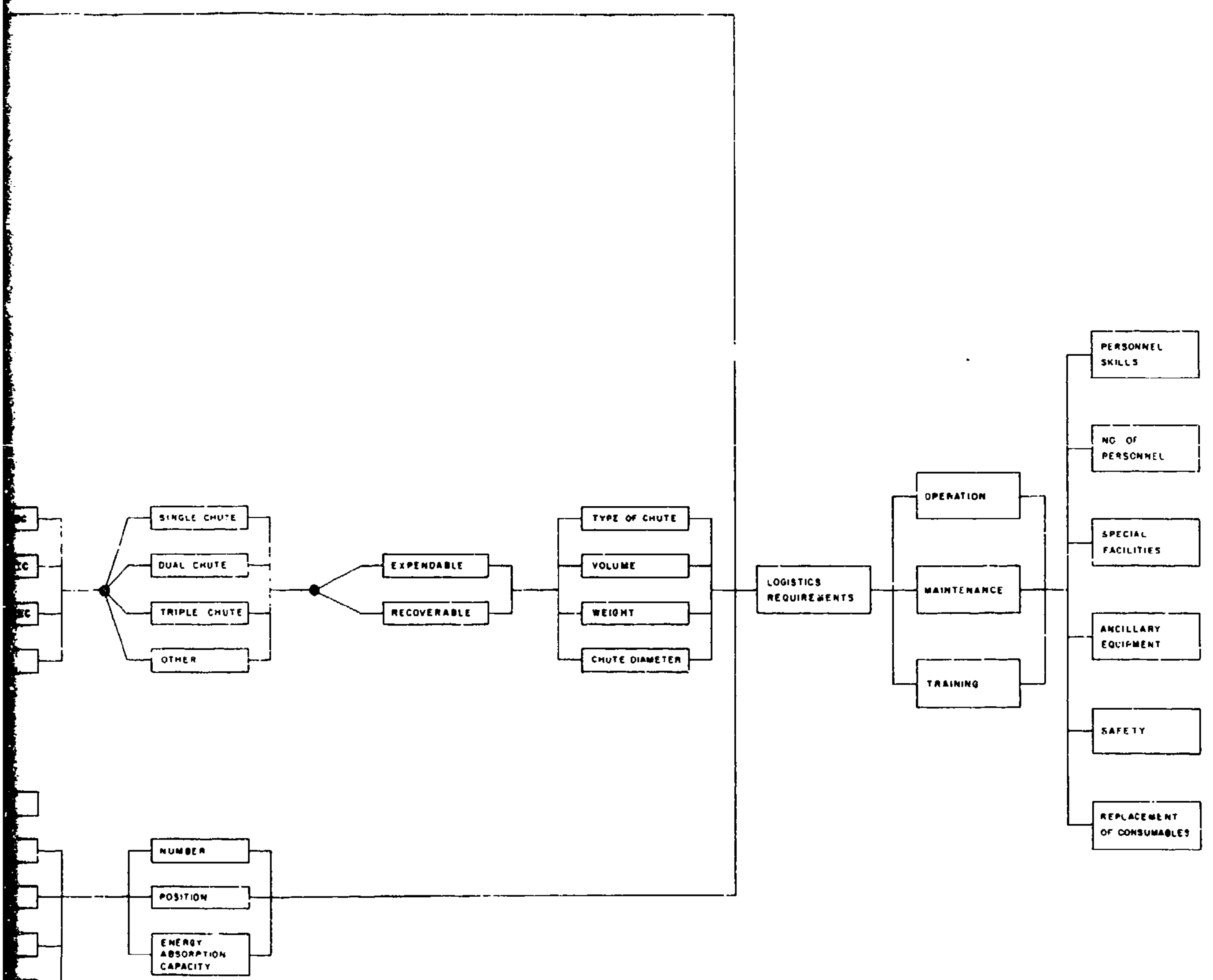

RECOVERY TIONS
DECELERATOR
DROGUE CHUTE
SPEED BRAKE
PITCH - UP
OTHER
NO DECELERATOR
SEPARATION OF PAYLOAD
AIR
IN - FLIGHT ARREST
RE - ENGAGE TOWLINE
MID-AIR RETRIEVAL (MARS)
OTHER
GROUND
ROTOR
PARACHUTE
TOW ON
GROUND ARREST
AIR CUSHION SYSTEM
SKIDS
GEAR / WHEELS
OTHER
VERTICAL DESCENT
STEERABLE
DESCENT VELOCITY
30 - 35 FT/SEC
20 - 30 FT/SEC
10 - 20 FT/SEC
OTHER
SHOCK ATTENUATOR
NONE
AIR BAG
TOR - SHOK
SPIKE
OTHER
DWG NC 6810 - 02 - 2500, SHT 3



DECISION TREE - REMOTELY PILOTED VEHICLE - RECOVE

BUCKNER 4-30-76

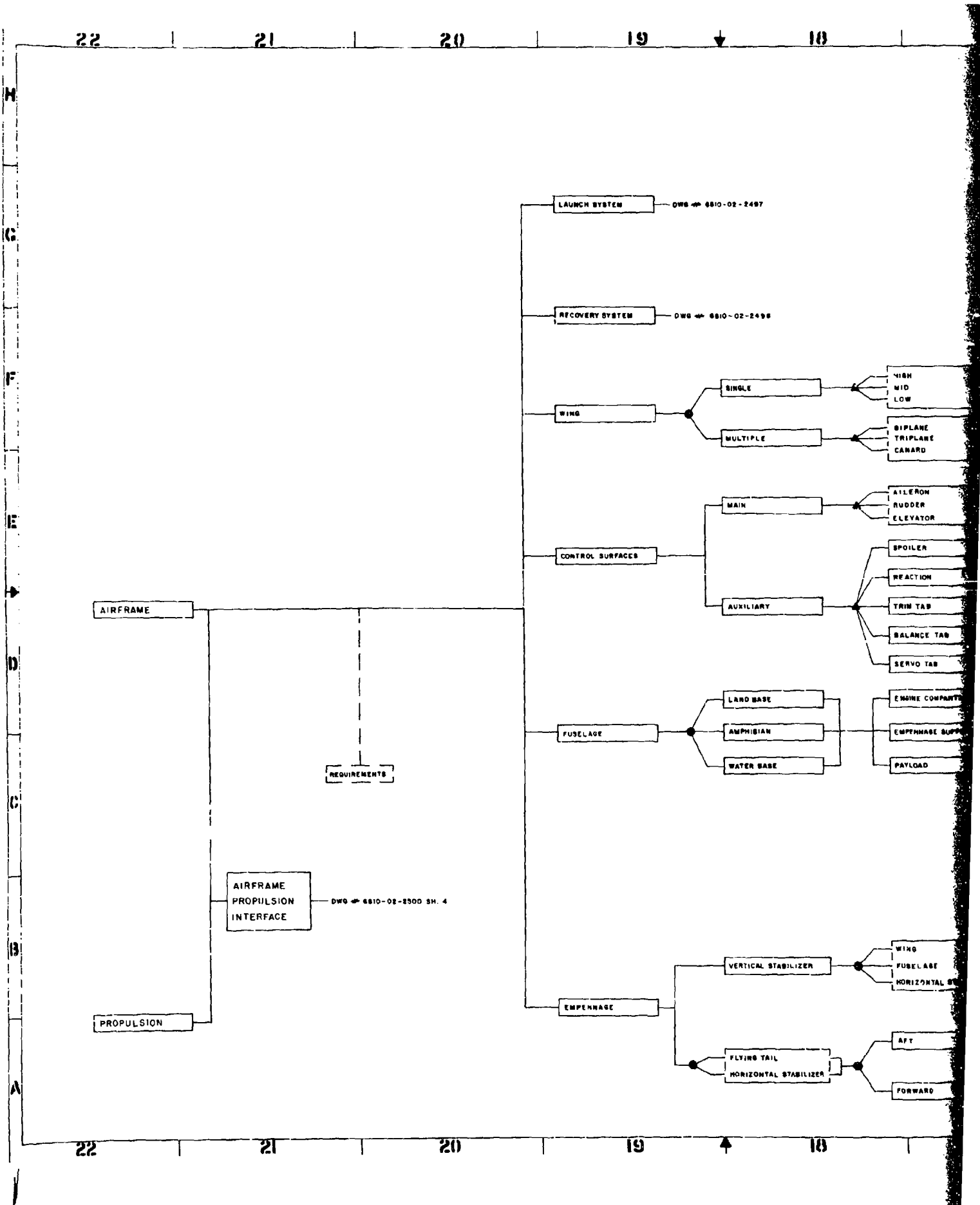
J 14590 6810 - 05

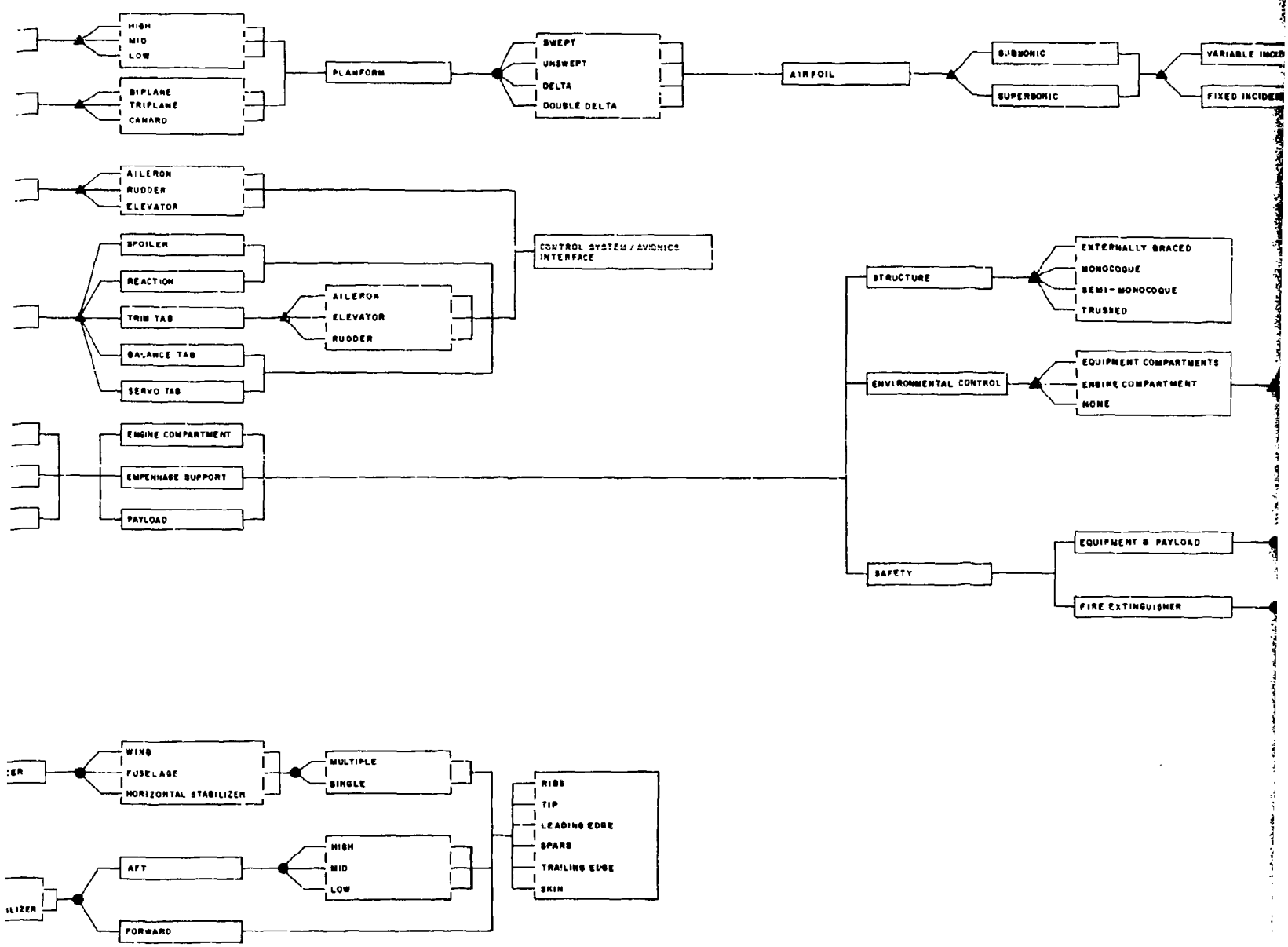


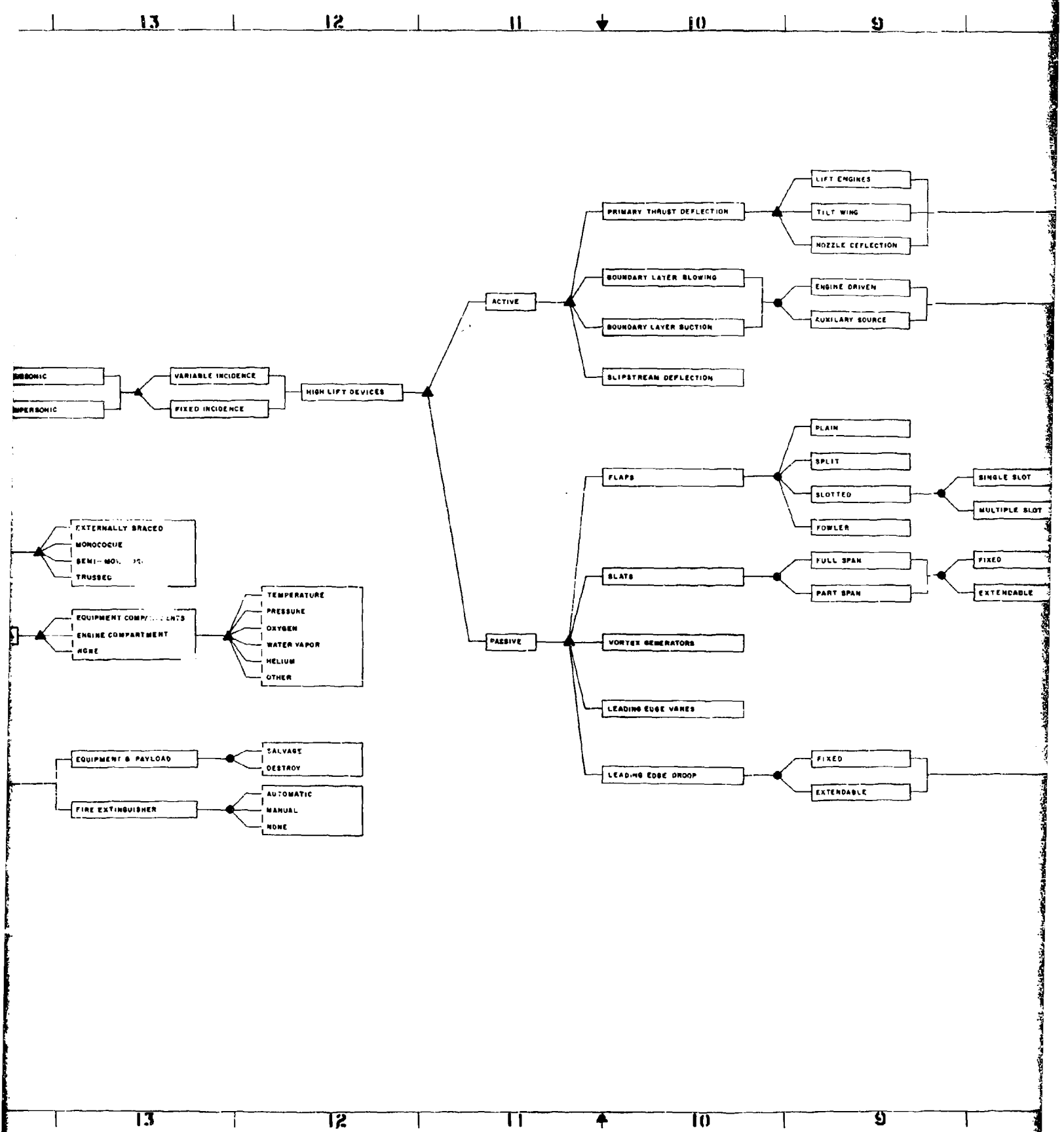
DECISION TREE – REMOTELY PILOTED VEHICLE – RECOVERY

DRAWN BUCKNER 4-30-76

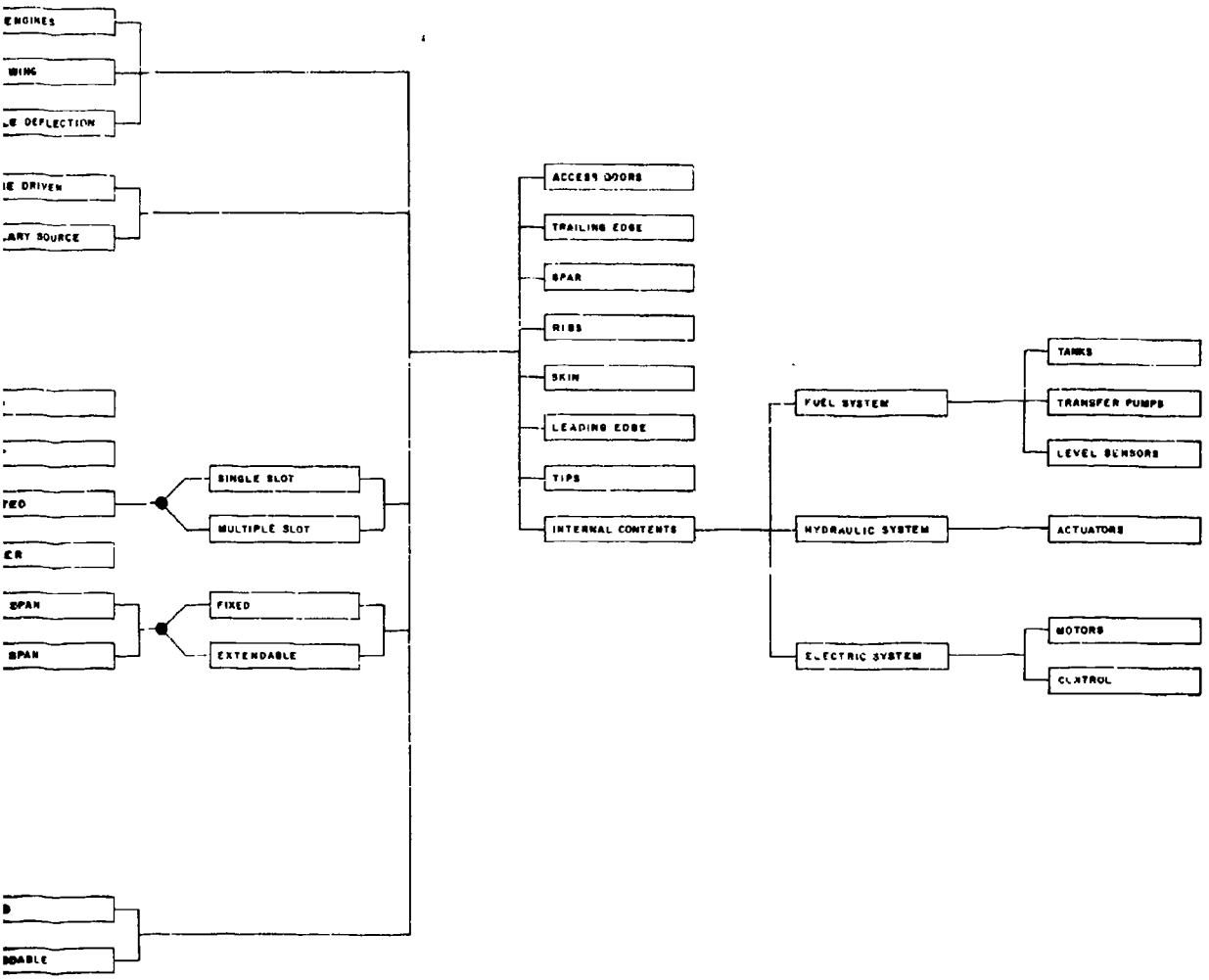
J 14580 6810-02-2490

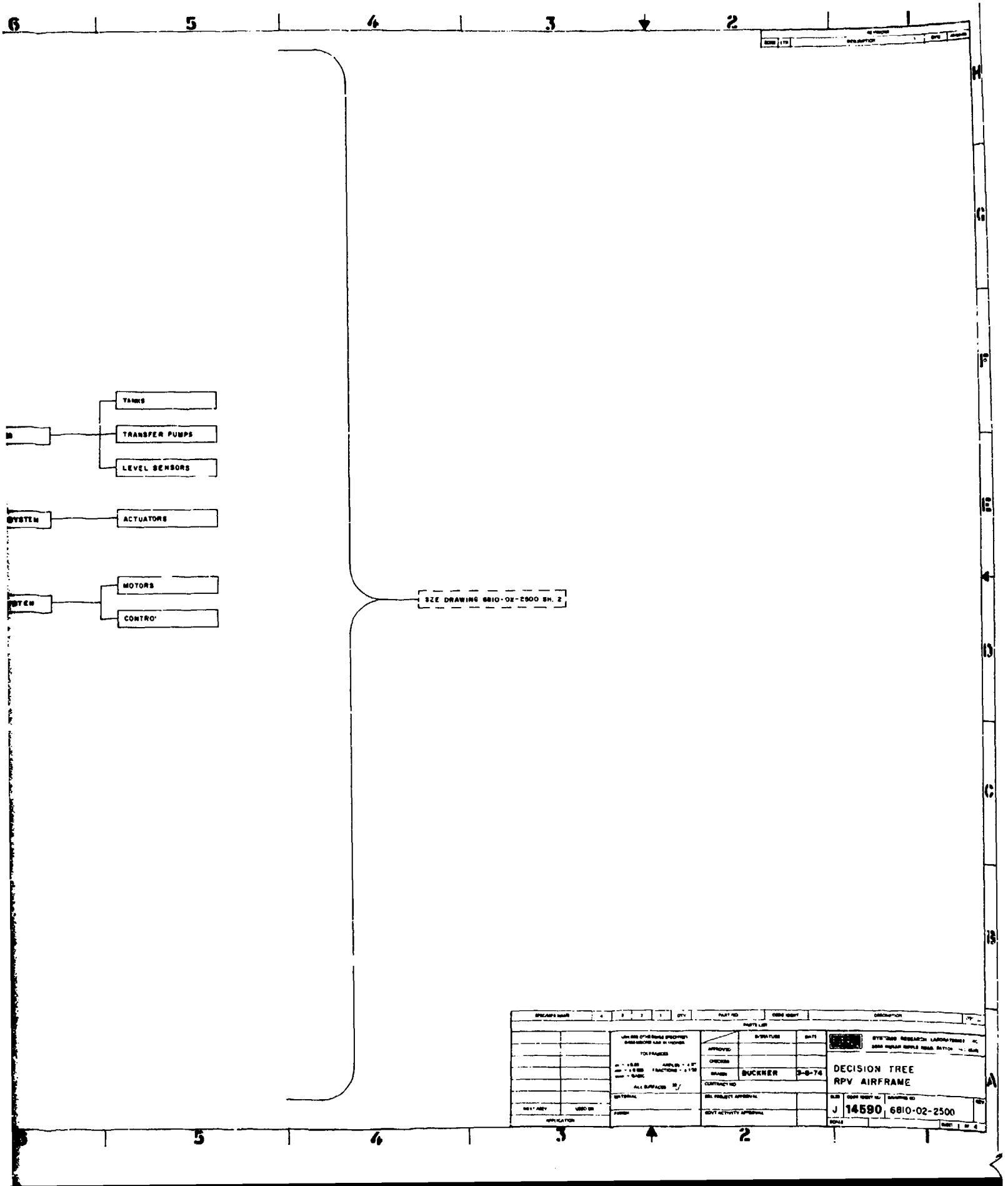

22
21
20
19
18
H
G
F
E
D
C
B
A
AIRFRAME
PROPULSION
REQUIREMENTS
AIRFRAME PROPULSION INTERFACE
DWG ⇒ 6810-02-2500 SH. 4
LAUNCH SYSTEM
DWG ⇒ 6810-02-2497
RECOVERY SYSTEM
DWG ⇒ 6810-02-2496
WING
SINGLE
MULTIPLE
HIGH
MID
LOW
BIPLANE
TRIPLANE
CANARD
CONTROL SURFACES
MAIN
AUXILIARY
AILERON
RUDDER
ELEVATOR
SPOILER
REACTION
TRIM TAB
BALANCE TAB
SERVO TAB
FUSELAGE
LAND BASE
AMPHIBIAN
WATER BASE
PAYLOAD
EMPENNAGE
VERTICAL STABILIZER
WING
FUSELAGE
FLYING TAIL
HORIZONTAL STABILIZER
AFT
FORWARD


HIGH
MID
LOW
BIPLANE
TRIPLANE
CANARD
PLANFORM
SWEPT
UNSWEPT
DELTA
DOUBLE DELTA
AIRFOIL
SUBSONIC
SUPERSONIC
VARIABLE INCIDE
FIXED INCIDE
AILERON
RUDDER
ELEVATOR
SPOILER
REACTION
TRIM TAB
BALANCE TAB
SERVO TAB
AILERON
ELEVATOR
RUDDER
CONTROL SYSTEM / AVIONICS INTERFACE
ENGINE COMPARTMENT
EMPENNAGE SUPPORT
PAYLOAD
STRUCTURE
EXTERNALLY BRACED
MONOCOQUE
SEMI-MONOCOQUE
TRUSSED
ENVIRONMENTAL CONTROL
EQUIPMENT COMPARTMENTS
ENGINE COMPARTMENT
NONE
SAFETY
EQUIPMENT & PAYLOAD
FIRE EXTINGUISHER
WING
FUSELAGE
HORIZONTAL STABILIZER
MULTIPLE
SINGLE
AFT
FORWARD
HIGH
MID
LOW
RIBS
TIP
LEADING EDGE
SPARS
TRAILING EDGE
SKIN


13
12
11
10
9
SUBSONIC
SUPERSONIC
VARIABLE INCIDENCE
FIXED INCIDENCE
HIGH LIFT DEVICES
ACTIVE
PASSIVE
PRIMARY THRUST DEFLECTION
LIFT ENGINES
TILT WING
NOZZLE DEFLECTION
BOUNDARY LAYER BLOWING
BOUNDARY LAYER SUCTION
ENGINE DRIVEN
AUXILARY SOURCE
SLIPSTREAM DEFLECTION
FLAPS
PLAIN
SPLIT
SLOTTED
FOWLER
SINGLE SLOT
MULTIPLE SLOT
SLATS
FULL SPAN
PART SPAN
FIXED
EXTENDABLE
VORTEX GENERATORS
LEADING EDGE VANES
LEADING EDGE DROOP
FIXED
EXTENDABLE
EXTERNALLY BRACED
MONOCOQUE
SEMI-MON...
TRUSSED
EQUIPMENT COMP... ENTS
ENGINE COMPARTMENT
NONE
TEMPERATURE
PRESSURE
OXYGEN
WATER VAPOR
HELIUM
OTHER
EQUIPMENT & PAYLOAD
SALVAGE
DESTROY
FIRE EXTINGUISHER
AUTOMATIC
MANUAL
NONE

3


ENGINES
WING
E DEFLECTION
E DRIVEN
ARY SOURCE
SINGLE SLOT
MULTIPLE SLOT
FIXED
EXTENDABLE
ACCESS DOORS
TRAILING EDGE
SPAR
RIBS
SKIN
LEADING EDGE
TIPS
INTERNAL CONTENTS
FUEL SYSTEM
TANKS
TRANSFER PUMPS
LEVEL SENSORS
HYDRAULIC SYSTEM
ACTUATORS
ELECTRIC SYSTEM
MOTORS
CONTROL


TANKS
TRANSFER PUMPS
LEVEL SENSORS
ACTUATORS
MOTORS
CONTRO'
SZE DRAWING 6810-02-2500 SH. 2
DECISION TREE
RPV AIRFRAME
BUCKNER
3-8-74
J 14590 6810-02-2500

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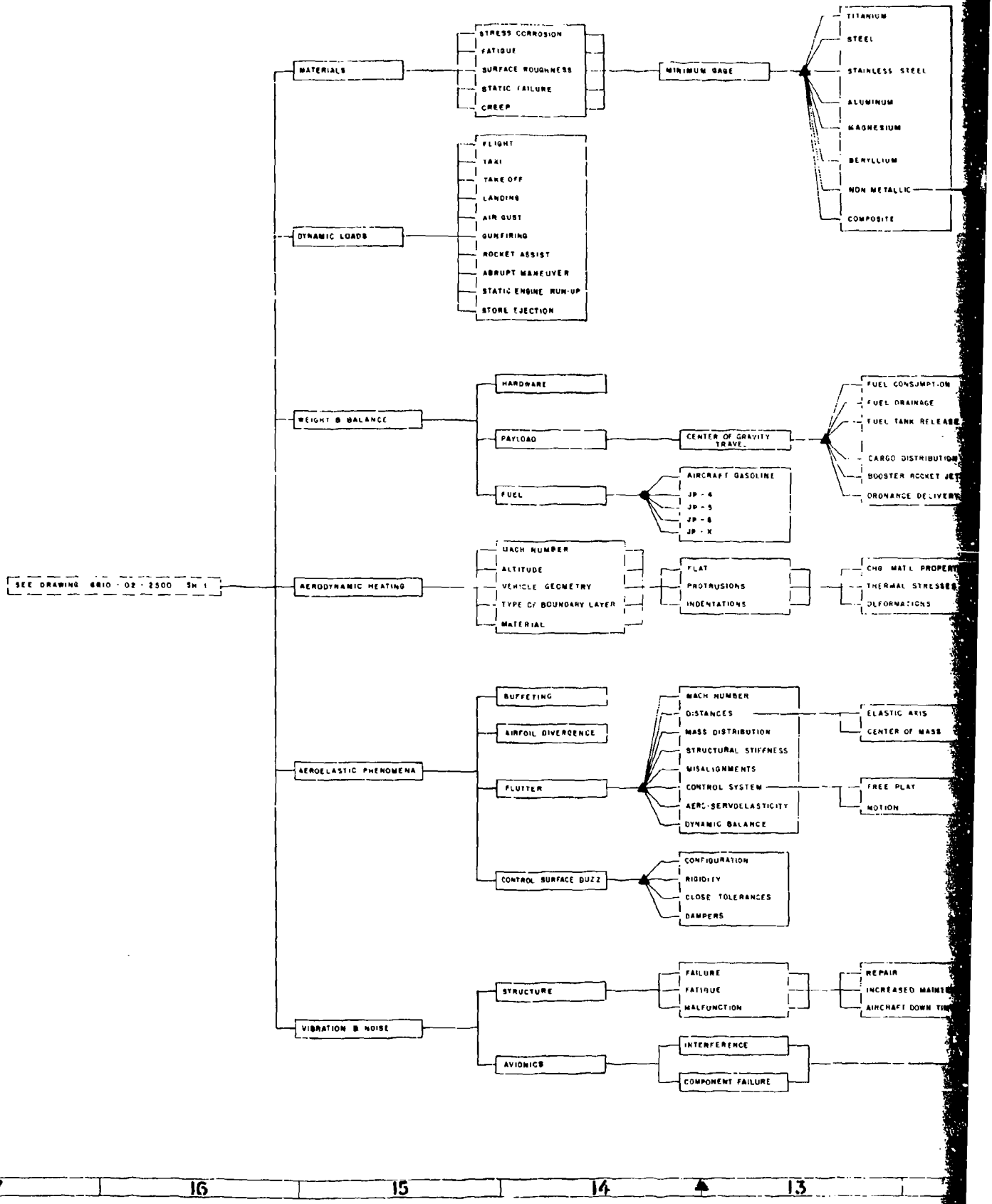
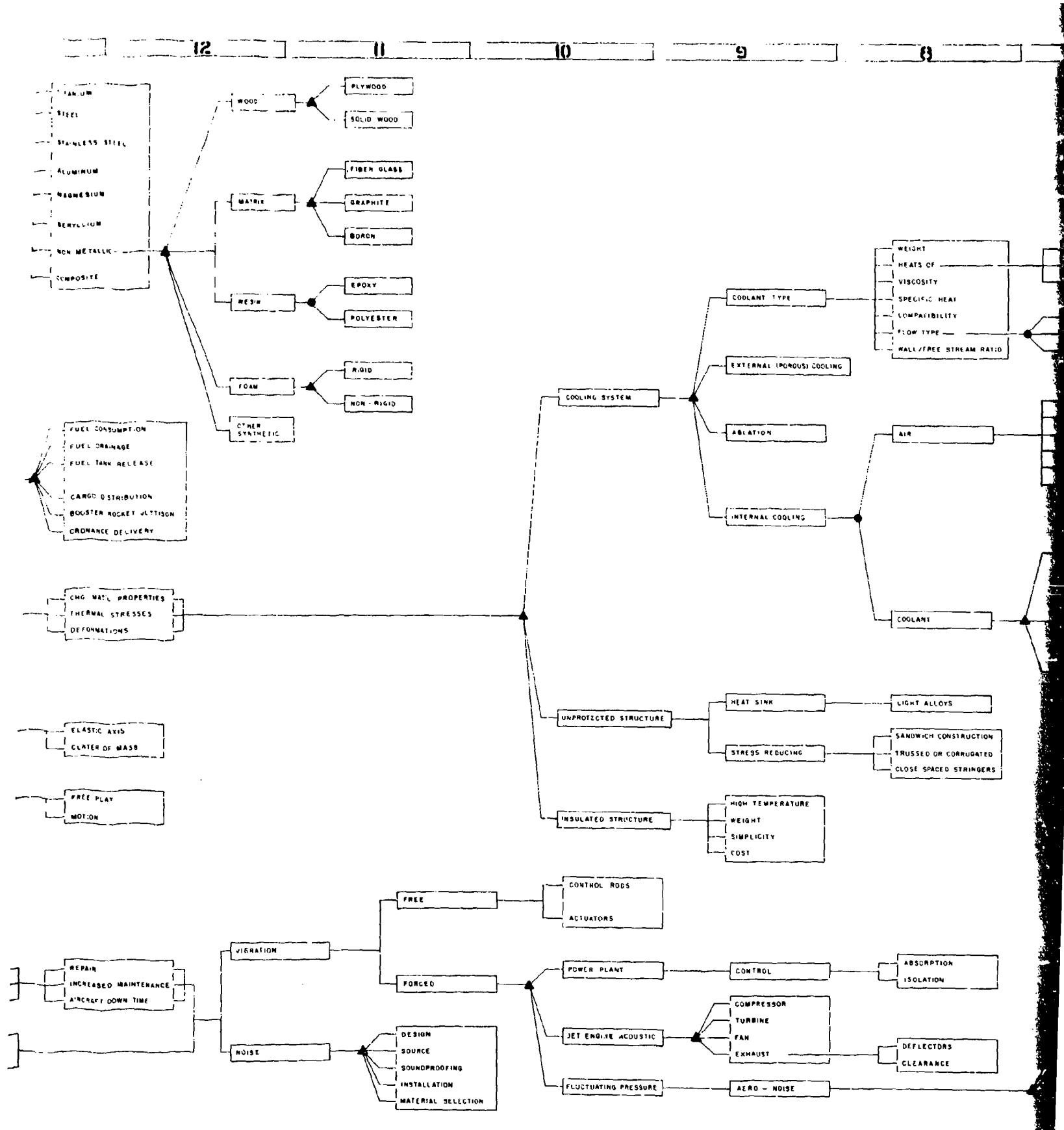
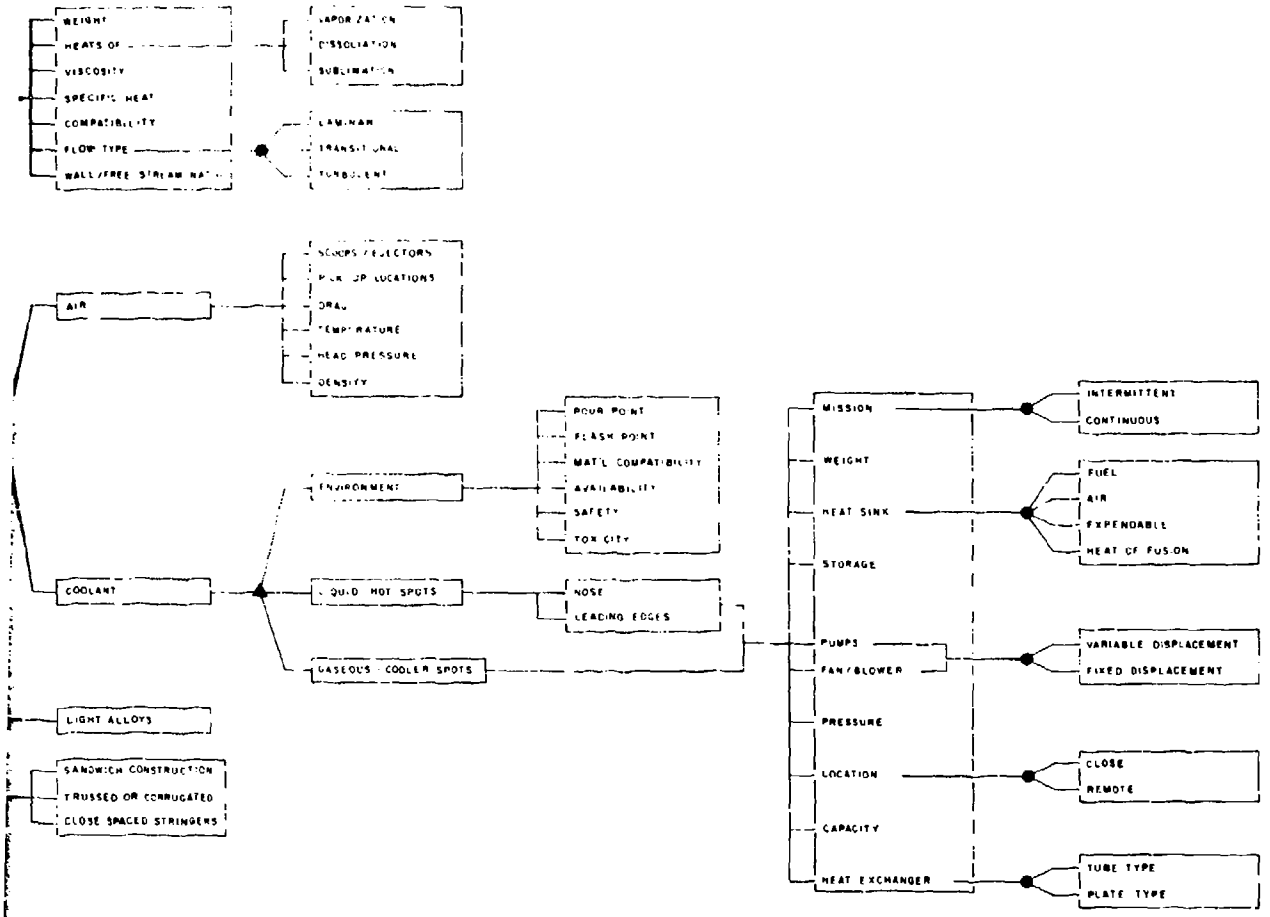
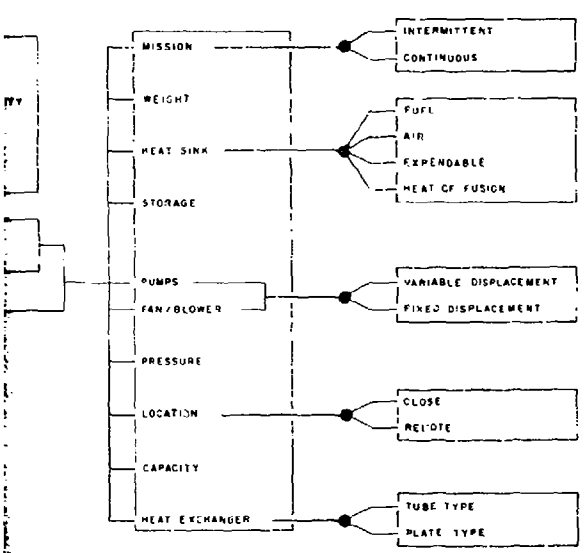

17
16
15
14
13
H
G
F
E
D
C
B
A
SEE DRAWING 6810-02-2500 SH 1
MATERIALS
STRESS CORROSION
FATIGUE
SURFACE ROUGHNESS
STATIC FAILURE
CREEP
MINIMUM GAGE
TITANIUM
STEEL
STAINLESS STEEL
ALUMINUM
MAGNESIUM
BERYLLIUM
NON METALLIC
COMPOSITE
DYNAMIC LOADS
FLIGHT
TAXI
TAKE OFF
LANDING
AIR GUST
GUNFIRING
ROCKET ASSIST
ABRUPT MANEUVER
STATIC ENGINE RUN-UP
STORE EJECTION
WEIGHT & BALANCE
HARDWARE
PAYLOAD
CENTER OF GRAVITY TRAVEL
FUEL CONSUMPTION
FUEL DRAINAGE
FUEL TANK RELEASE
CARGO DISTRIBUTION
BOOSTER ROCKET JET
ORDNANCE DELIVERY
FUEL
AIRCRAFT GASOLINE
JP-4
JP-5
JP-6
JP-X
AERODYNAMIC HEATING
MACH NUMBER
ALTITUDE
VEHICLE GEOMETRY
TYPE OF BOUNDARY LAYER
MATERIAL
FLAT
PROTRUSIONS
INDENTATIONS
CHG MATL PROPERTI
THERMAL STRESSES
DEFORMATIONS
AEROELASTIC PHENOMENA
BUFFETING
AIRFOIL DIVERGENCE
FLUTTER
CONTROL SURFACE BUZZ
MACH NUMBER
DISTANCES
MASS DISTRIBUTION
STRUCTURAL STIFFNESS
MISALIGNMENTS
CONTROL SYSTEM
AERO-SERVOELASTICITY
DYNAMIC BALANCE
ELASTIC AXIS
CENTER OF MASS
FREE PLAY
MOTION
CONFIGURATION
RIGIDITY
CLOSE TOLERANCES
DAMPERS
VIBRATION & NOISE
STRUCTURE
AVIONICS
FAILURE
FATIGUE
MALFUNCTION
INTERFERENCE
COMPONENT FAILURE
REPAIR
INCREASED MAINTE
AIRCRAFT DOWN TI


12
11
10
9
8
TANIUM
STEEL
STAINLESS STEEL
ALUMINUM
MAGNESIUM
BERYLLIUM
NON METALLIC
COMPOSITE
WOOD
PLYWOOD
SOLID WOOD
MATRIX
FIBER GLASS
GRAPHITE
BORON
RESIN
EPOXY
POLYESTER
FOAM
RIGID
NON - RIGID
OTHER SYNTHETIC
FUEL CONSUMPTION
FUEL DRAINAGE
FUEL TANK RELEASE
CARGO DISTRIBUTION
BOOSTER ROCKET JETTISON
ORDNANCE DELIVERY
CHG MATL PROPERTIES
THERMAL STRESSES
DEFORMATIONS
ELASTIC AXIS
CENTER OF MASS
FREE PLAY
MOTION
REPAIR
INCREASED MAINTENANCE
AIRCRAFT DOWN TIME
VIBRATION
NOISE
FREE
FORCED
DESIGN
SOURCE
SOUNDPROOFING
INSTALLATION
MATERIAL SELECTION
CONTROL RODS
ACTUATORS
COOLING SYSTEM
COOLANT TYPE
EXTERNAL (POROUS) COOLING
ABLATION
INTERNAL COOLING
WEIGHT
HEATS OF
VISCOSITY
SPECIFIC HEAT
COMPATIBILITY
FLOW TYPE
WALL/FREE STREAM RATIO
AIR
COOLANT
UNPROTECTED STRUCTURE
HEAT SINK
STRESS REDUCING
LIGHT ALLOYS
SANDWICH CONSTRUCTION
TRUSSED OR CORRUGATED
CLOSE SPACED STRINGERS
INSULATED STRUCTURE
HIGH TEMPERATURE
WEIGHT
SIMPLICITY
COST
POWER PLANT
JET ENGINE ACOUSTIC
FLUCTUATING PRESSURE
CONTROL
COMPRESSOR
TURBINE
FAN
EXHAUST
AERO - NOISE
ABSORPTION
ISOLATION
DEFLECTORS
CLEARANCE
6810 - 02 - 2500
REV
SH 2
3
12
11
10
9
8

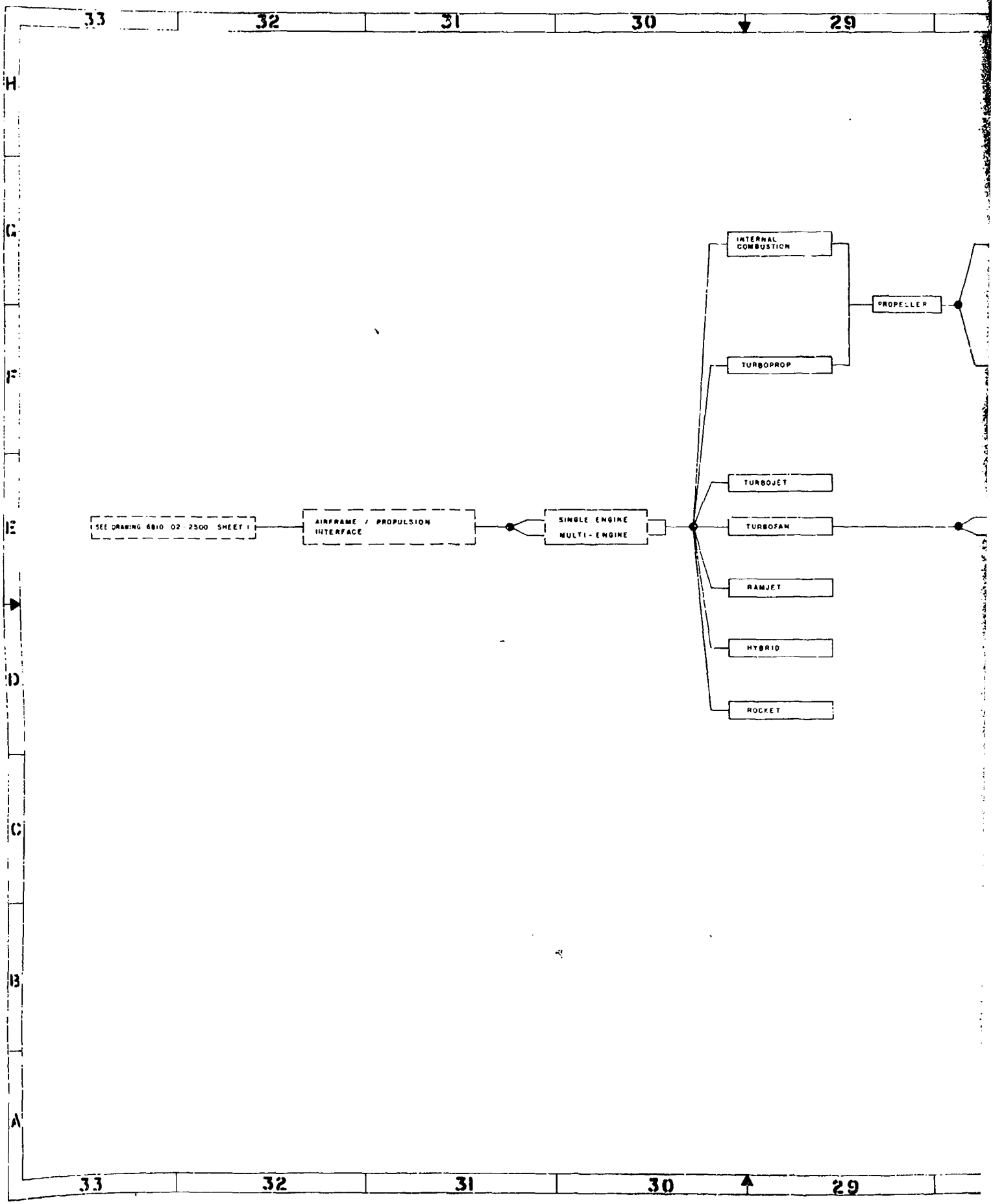

WEIGHT
HEATS OF
VISCOSITY
SPECIFIC HEAT
COMPATIBILITY
FLOW TYPE
VAPORIZATION
DISSOCIATION
SUBLIMATION
LAMINAR
TRANSITIONAL
TURBULENT
AIR
SCOOPS / EJECTORS
PUR JP LOCATIONS
DRAG
TEMPERATURE
HEAD PRESSURE
DENSITY
COOLANT
ENVIRONMENT
POUR POINT
FLASH POINT
MAT'L COMPATIBILITY
AVAILABILITY
SAFETY
TOXICITY
QUID HOT SPOTS
NOSE
LEADING EDGES
GASEOUS COOLER SPOTS
MISSION
WEIGHT
HEAT SINK
STORAGE
PUMPS
FAN/BLOWER
PRESSURE
LOCATION
CAPACITY
HEAT EXCHANGER
INTERMITTENT
CONTINUOUS
FUEL
AIR
EXPENDABLE
HEAT OF FUSION
VARIABLE DISPLACEMENT
FIXED DISPLACEMENT
CLOSE
REMOTE
TUBE TYPE
PLATE TYPE
LIGHT ALLOYS
SANDWICH CONSTRUCTION
TRUSSED OR CORRUGATED
CLOSE SPACED STRINGERS
ABSORPTION
ISOLATION
DEFLECTORS
CLEARANCE
BASE PRESSURE
CAVITIES
WAKES
OSCILLATING SHOCKS
BOUNDARY LAYER TURBULENCE

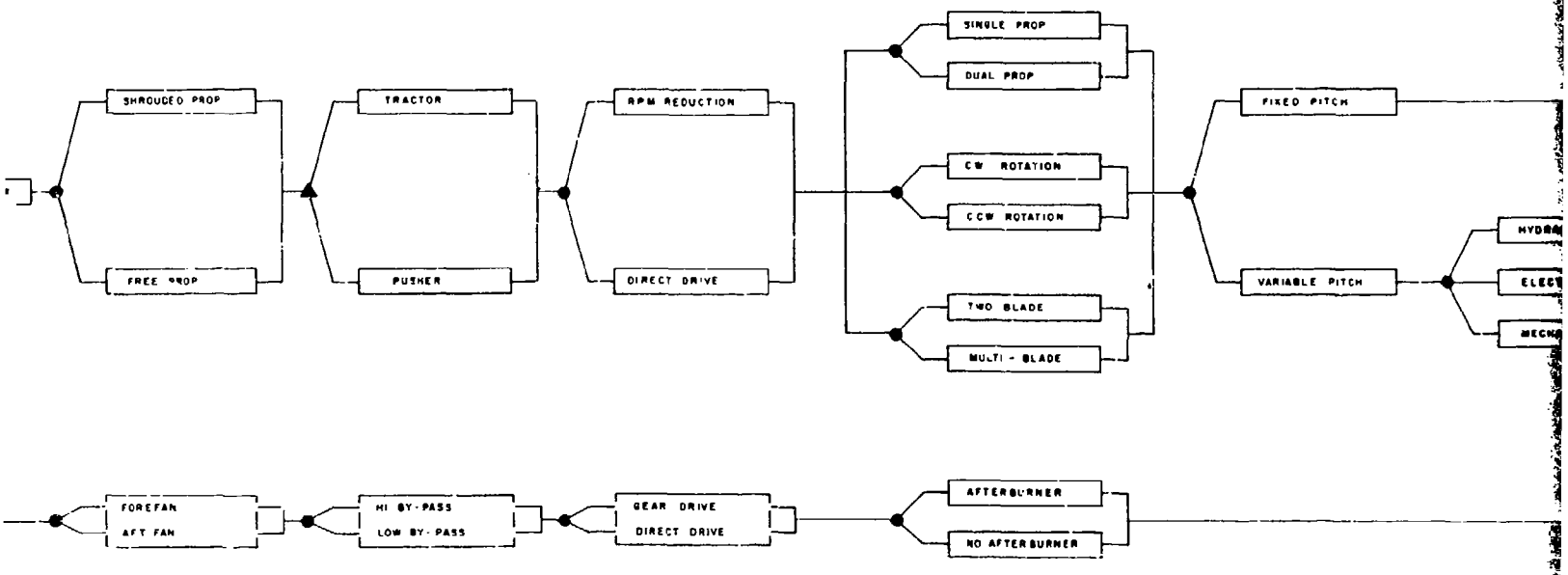


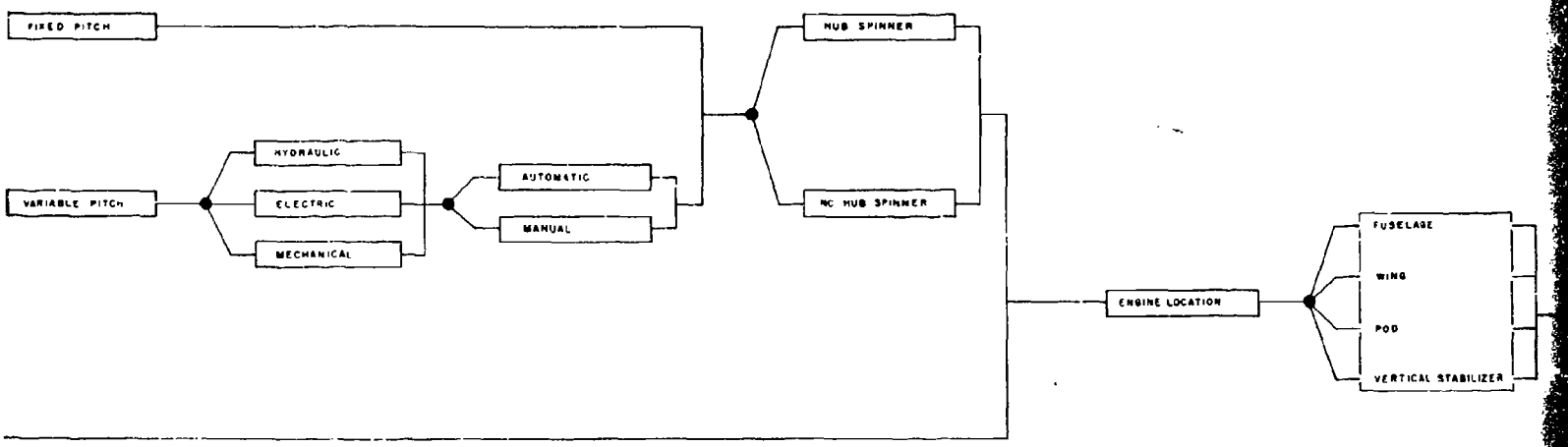
BUCKNER 3/9/74

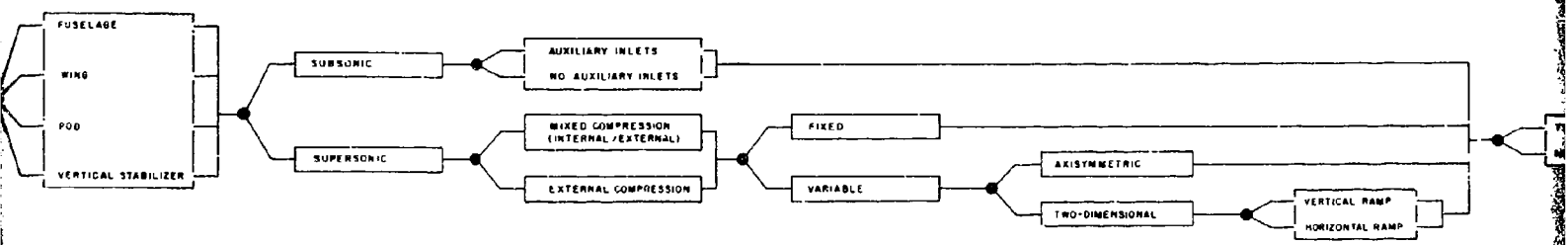
DECISION TREE – RPV AIRFRAME

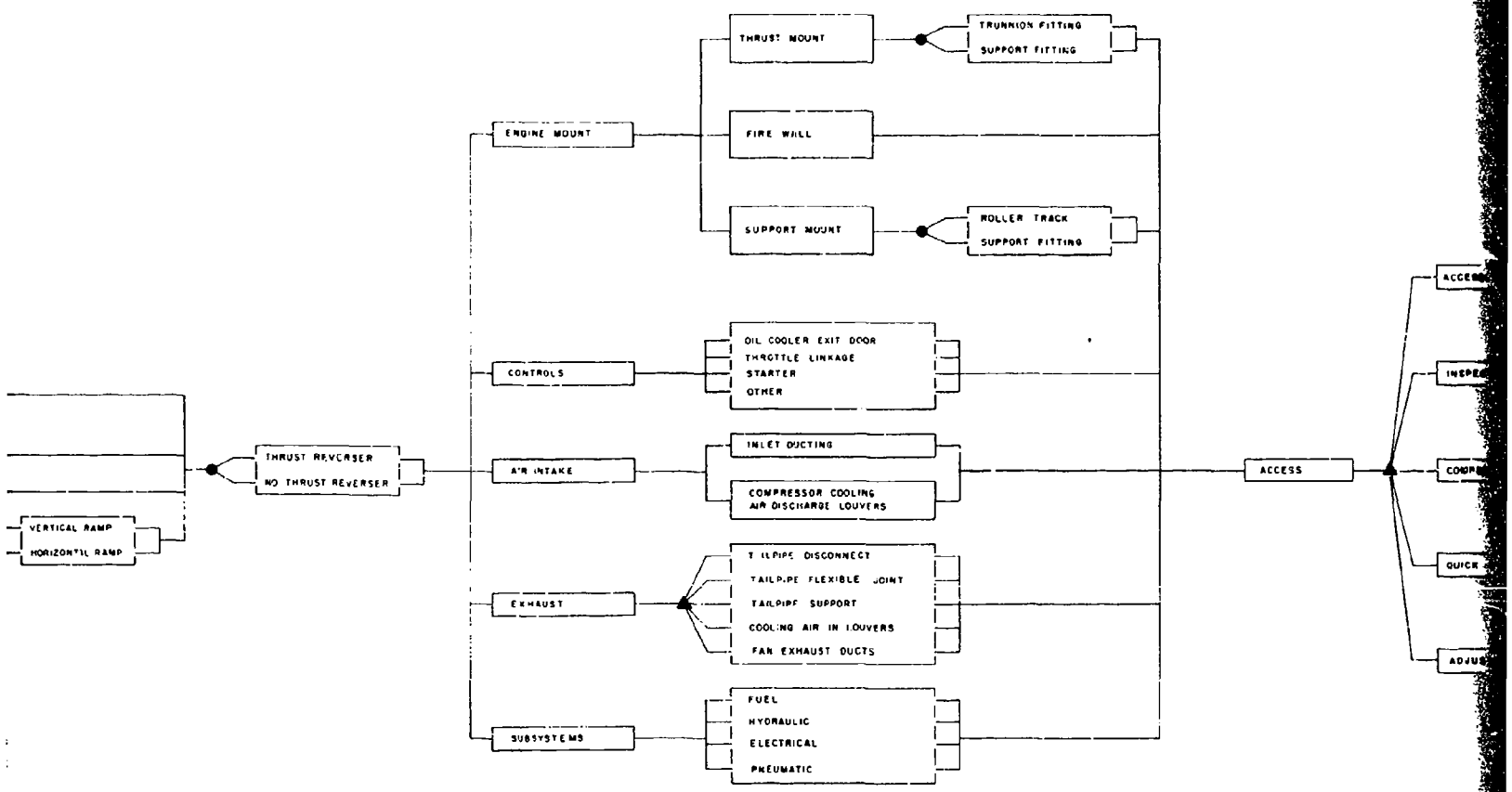
J 14590 6810-02-2500


33
32
31
30
29
H
G
F
E
D
C
B
A
(SEE DRAWING 6810 02-2500 SHEET 1)
AIRFRAME / PROPULSION INTERFACE
SINGLE ENGINE
MULTI-ENGINE
INTERNAL COMBUSTION
TURBOPROP
PROPELLER
TURBOJET
TURBOFAN
RAMJET
HYBRID
ROCKET

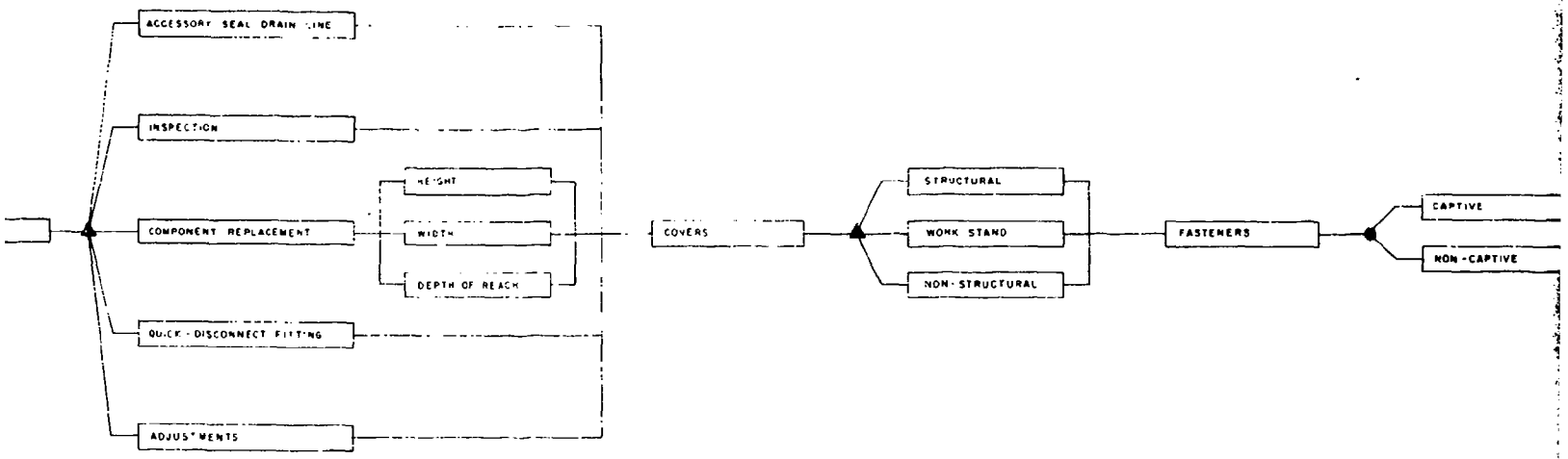

SHROUDED PROP
FREE PROP
TRACTOR
PUSHER
RPM REDUCTION
DIRECT DRIVE
SINGLE PROP
DUAL PROP
CW ROTATION
CCW ROTATION
TWO BLADE
MULTI - BLADE
FIXED PITCH
VARIABLE PITCH
FOREFAN
AFT FAN
HI BY-PASS
LOW BY-PASS
GEAR DRIVE
DIRECT DRIVE
AFTERBURNER
NO AFTERBURNER

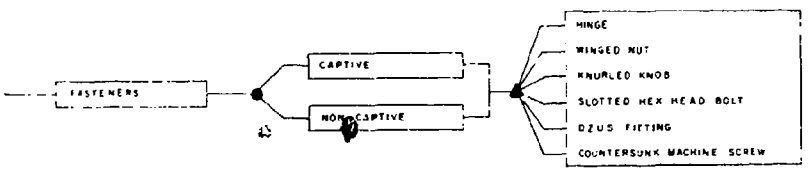

FIXED PITCH
VARIABLE PITCH
HYDRAULIC
ELECTRIC
MECHANICAL
AUTOMATIC
MANUAL
HUB SPINNER
NC HUB SPINNER
ENGINE LOCATION
FUSELAGE
WING
POD
VERTICAL STABILIZER


FUSELAGE
WING
POD
VERTICAL STABILIZER
SUBSONIC
SUPERSONIC
AUXILIARY INLETS
NO AUXILIARY INLETS
MIXED COMPRESSION (INTERNAL/EXTERNAL)
EXTERNAL COMPRESSION
FIXED
VARIABLE
AXISYMMETRIC
TWO-DIMENSIONAL
VERTICAL RAMP
HORIZONTAL RAMP

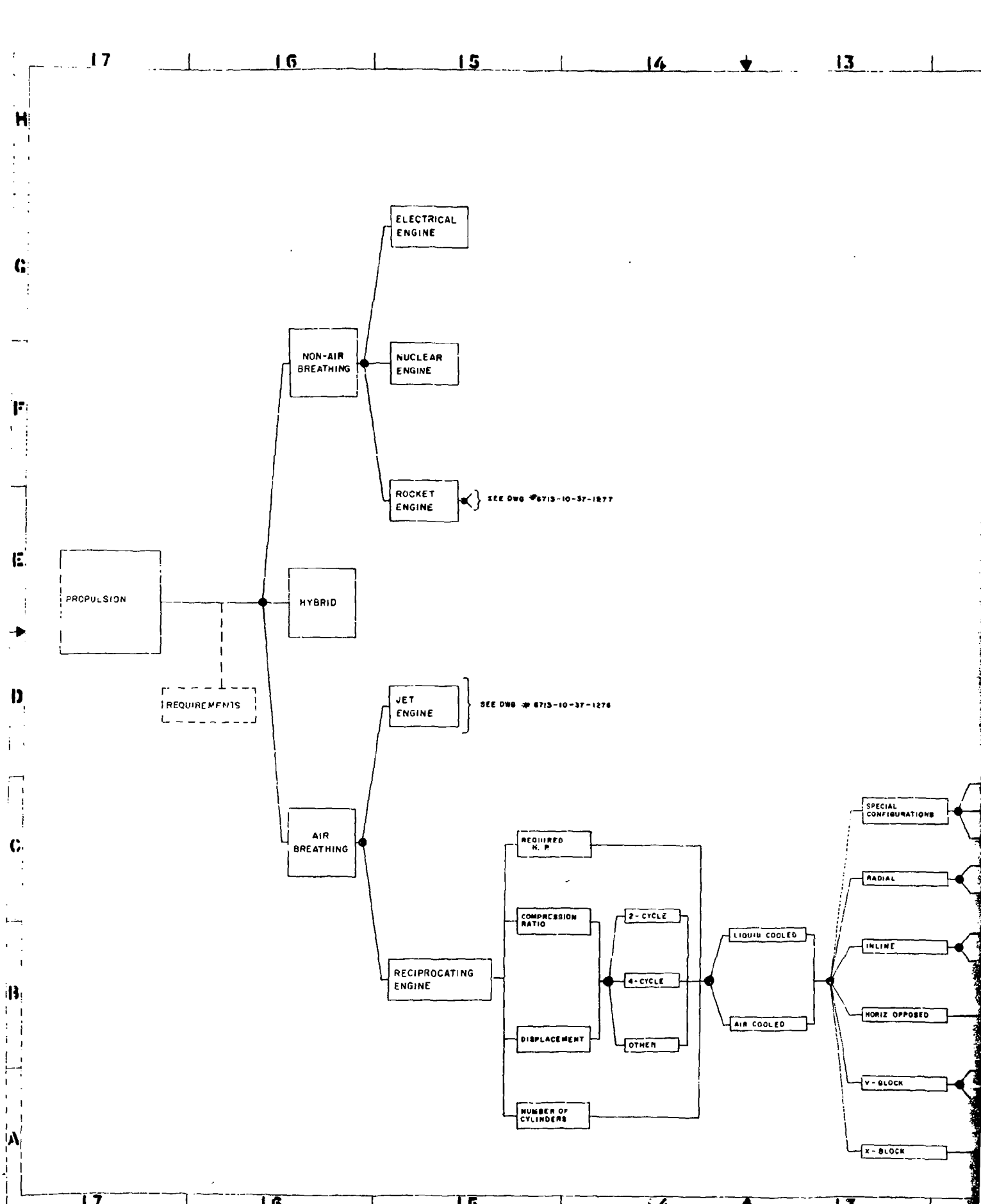


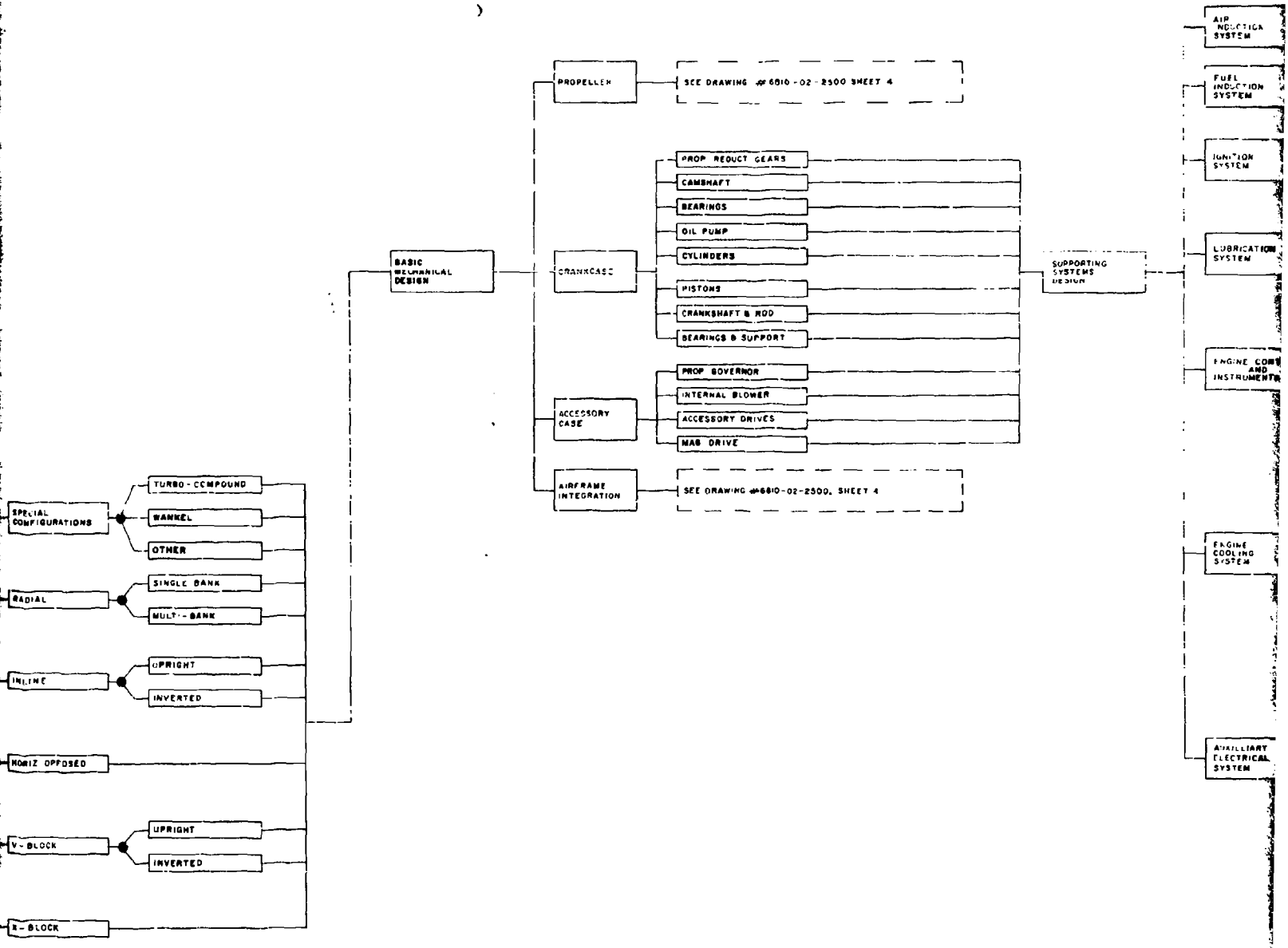
6810-02-2500 REV 4


ACCESSORY SEAL DRAIN LINE
INSPECTION
COMPONENT REPLACEMENT
HEIGHT
WIDTH
DEPTH OF REACH
QUICK - DISCONNECT FITTING
ADJUSTMENTS
COVERS
STRUCTURAL
WORK STAND
NON - STRUCTURAL
FASTENERS
CAPTIVE
NON - CAPTIVE

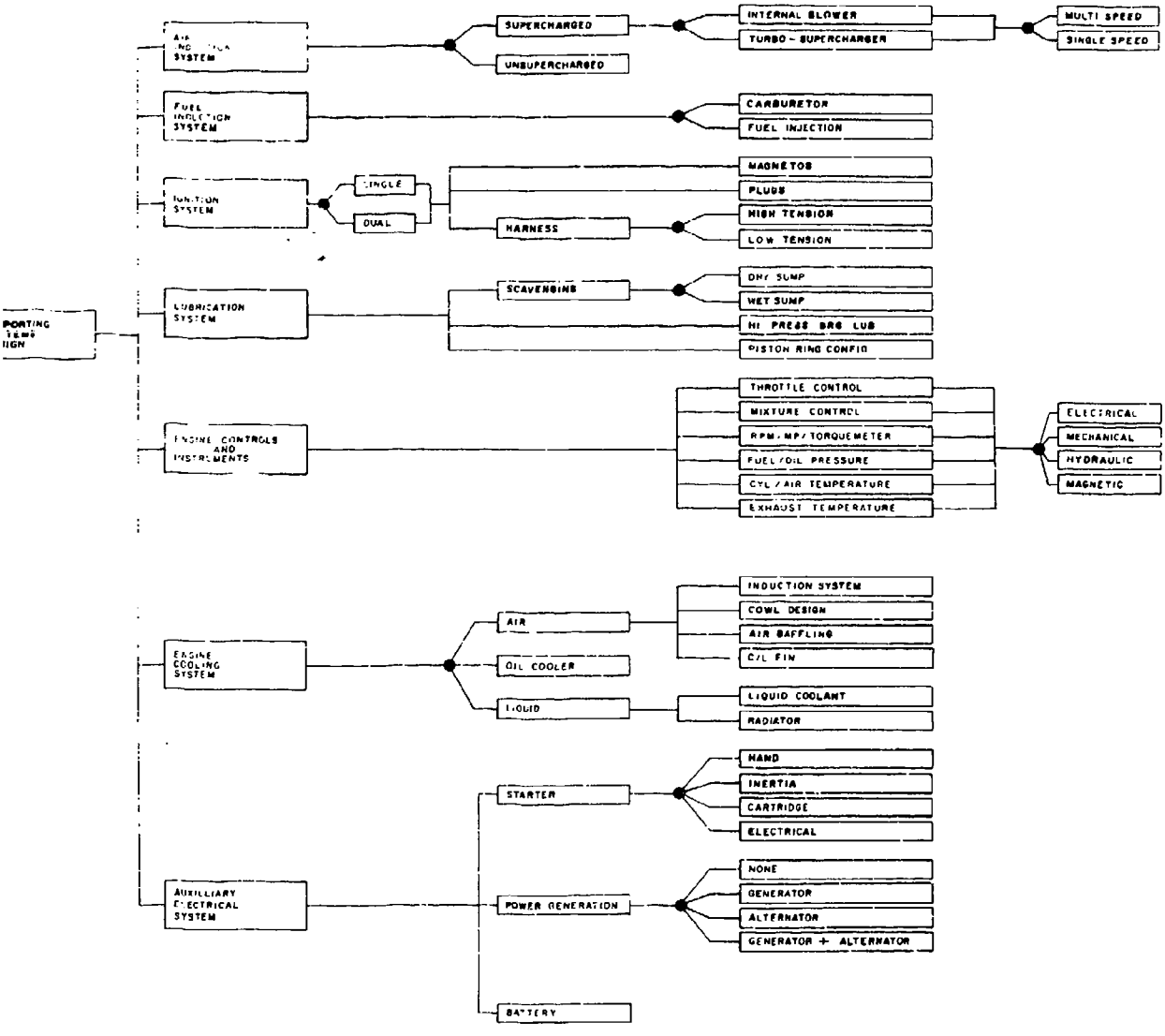


		DRAWN	BUCHNER	5-20-70
				DECISION TREE RPV AIRFRAME
			J	14590
				6810-02-2500

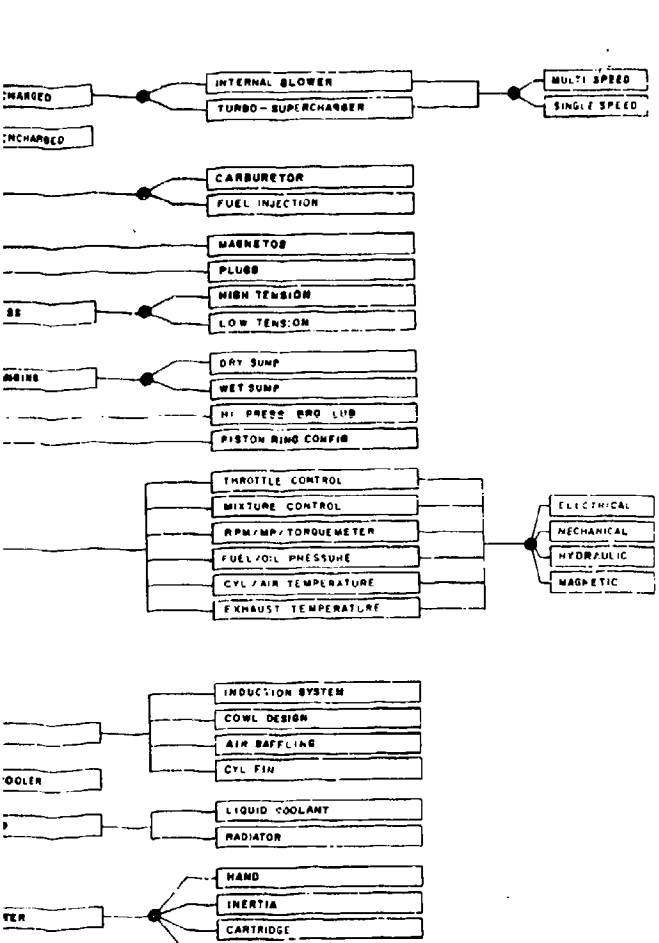

PROPULSION
REQUIREMENTS
NON-AIR BREATHING
HYBRID
AIR BREATHING
ELECTRICAL ENGINE
NUCLEAR ENGINE
ROCKET ENGINE
SEE DWG #6713-10-37-1277
JET ENGINE
SEE DWG #6713-10-37-1276
RECIPROCATING ENGINE
REQUIRED H. P.
COMPRESSION RATIO
DISPLACEMENT
NUMBER OF CYLINDERS
2-CYCLE
4-CYCLE
OTHER
LIQUID COOLED
AIR COOLED
SPECIAL CONFIGURATIONS
RADIAL
INLINE
HORIZ OPPOSED
V-BLOCK
X-BLOCK



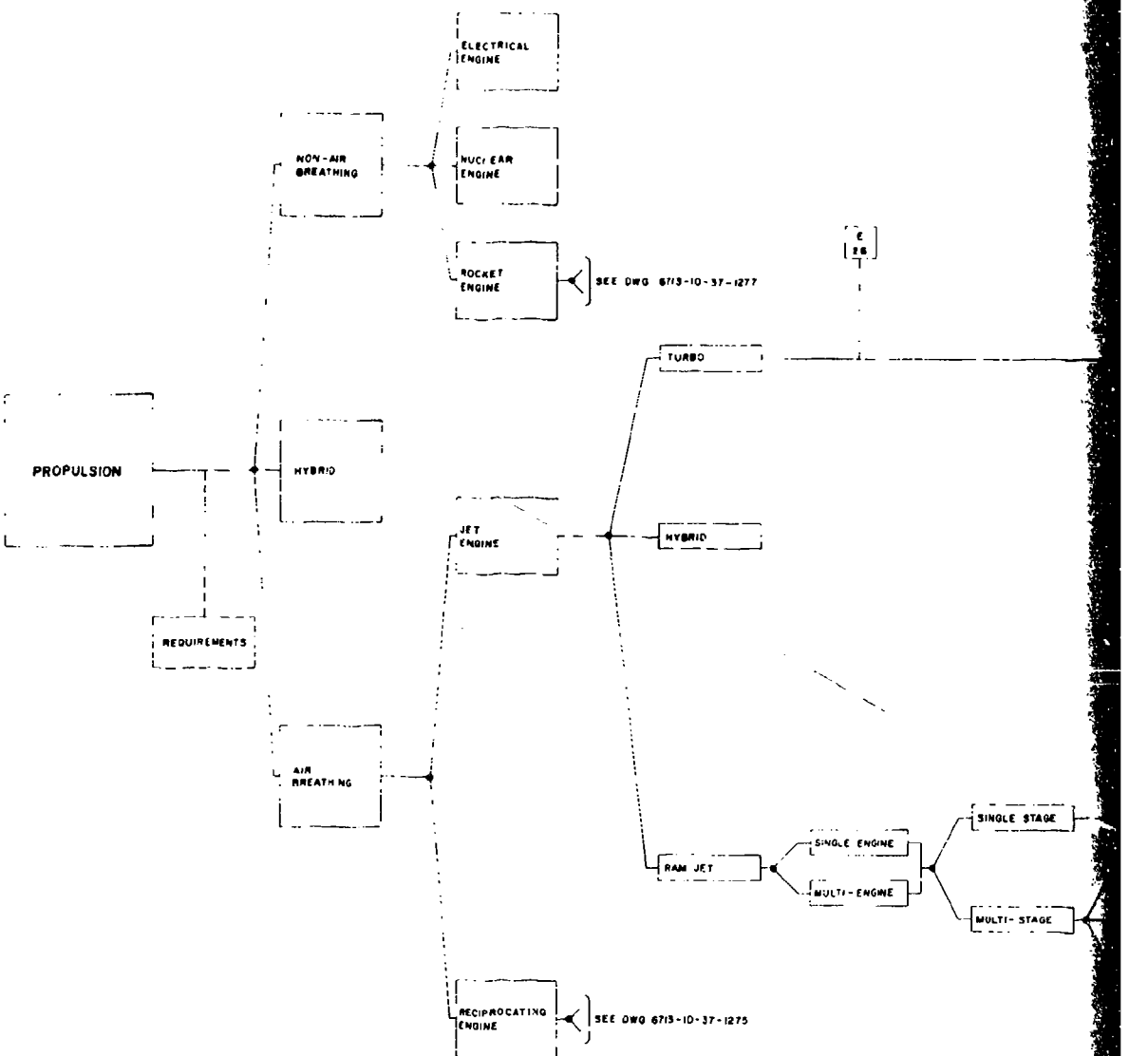
6713-10-37-1275 REV C

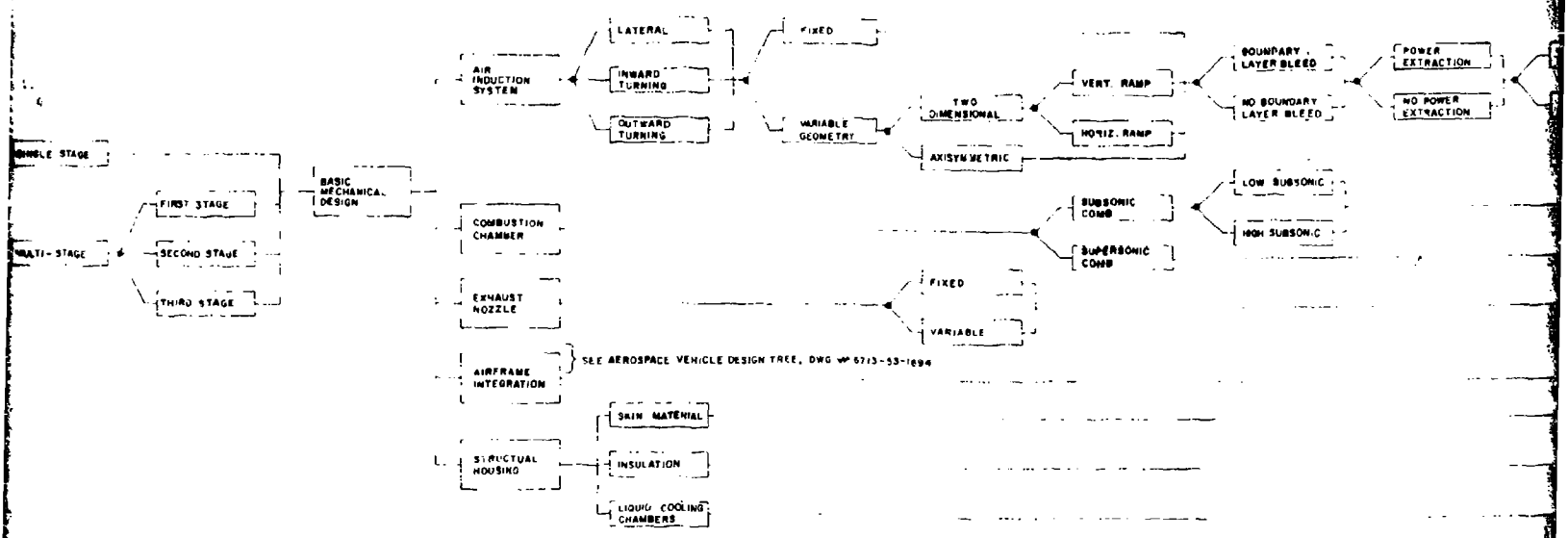

SUPERCHARGED
UNSUPERCHARGED
INTERNAL BLOWER
TURBO - SUPERCHARGER
MULTI SPEED
SINGLE SPEED
FUEL INJECTION SYSTEM
CARBURETOR
FUEL INJECTION
SINGLE
DUAL
MAGNETOS
PLUGS
HARNESS
HIGH TENSION
LOW TENSION
LUBRICATION SYSTEM
SCAVENGING
DRY SUMP
WET SUMP
HI PRESS BRG LUB
PISTON RING CONFIG
THROTTLE CONTROL
MIXTURE CONTROL
RPM / MP / TORQUEMETER
FUEL / OIL PRESSURE
CYL / AIR TEMPERATURE
EXHAUST TEMPERATURE
ELECTRICAL
MECHANICAL
HYDRAULIC
MAGNETIC
ENGINE CONTROLS AND INSTRUMENTS
ENGINE COOLING SYSTEM
AIR
OIL COOLER
LIQUID
INDUCTION SYSTEM
COWL DESIGN
AIR BAFFLING
CYL FIN
LIQUID COOLANT
RADIATOR
STARTER
HAND
INERTIA
CARTRIDGE
ELECTRICAL
AUXILIARY ELECTRICAL SYSTEM
POWER GENERATION
NONE
GENERATOR
ALTERNATOR
GENERATOR + ALTERNATOR
BATTERY

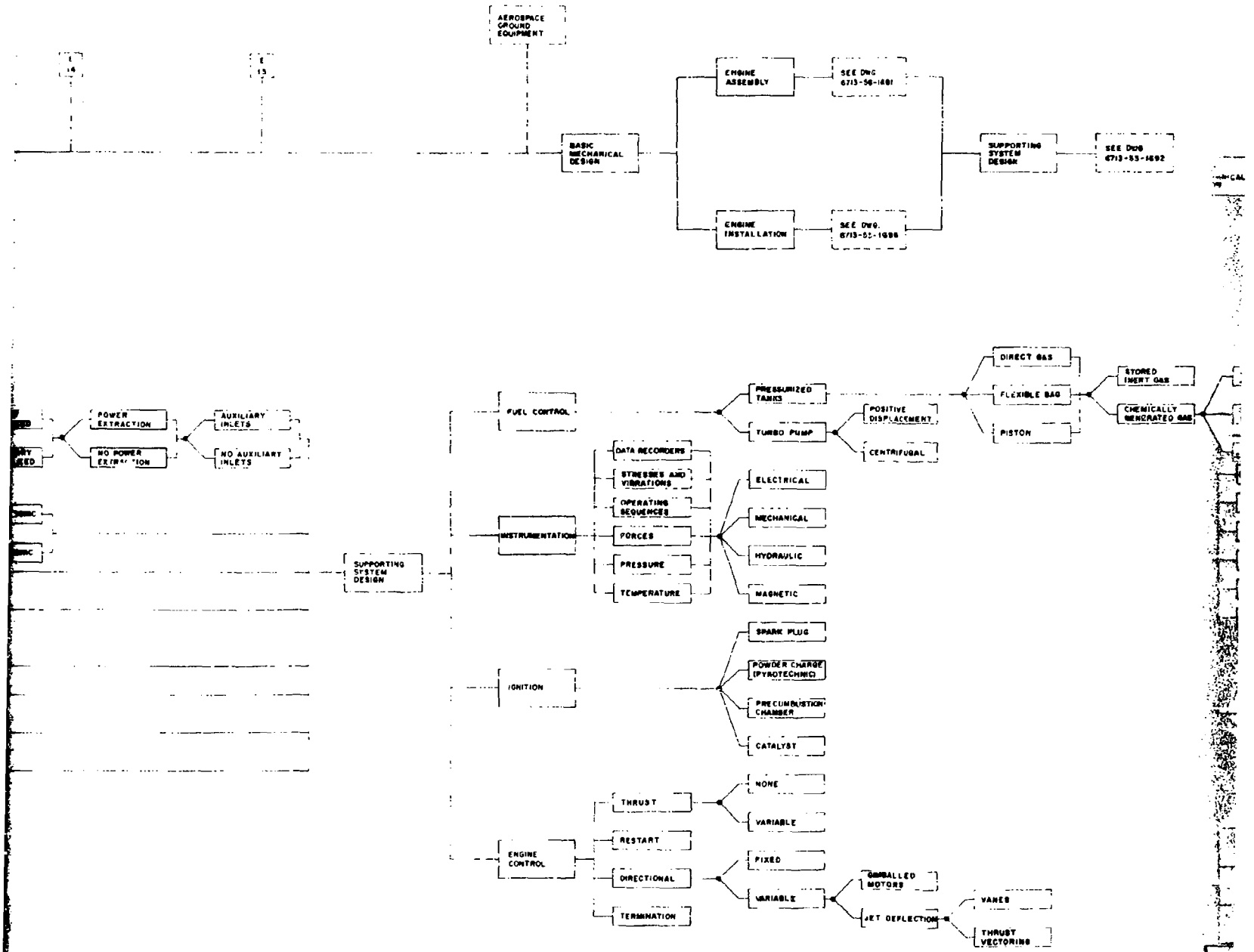
ZONE	LTR	DESCRIPTION	DATE	APPROVED
	C	REDRAWN WITH CHANGES	2-26-74	BUCKNER



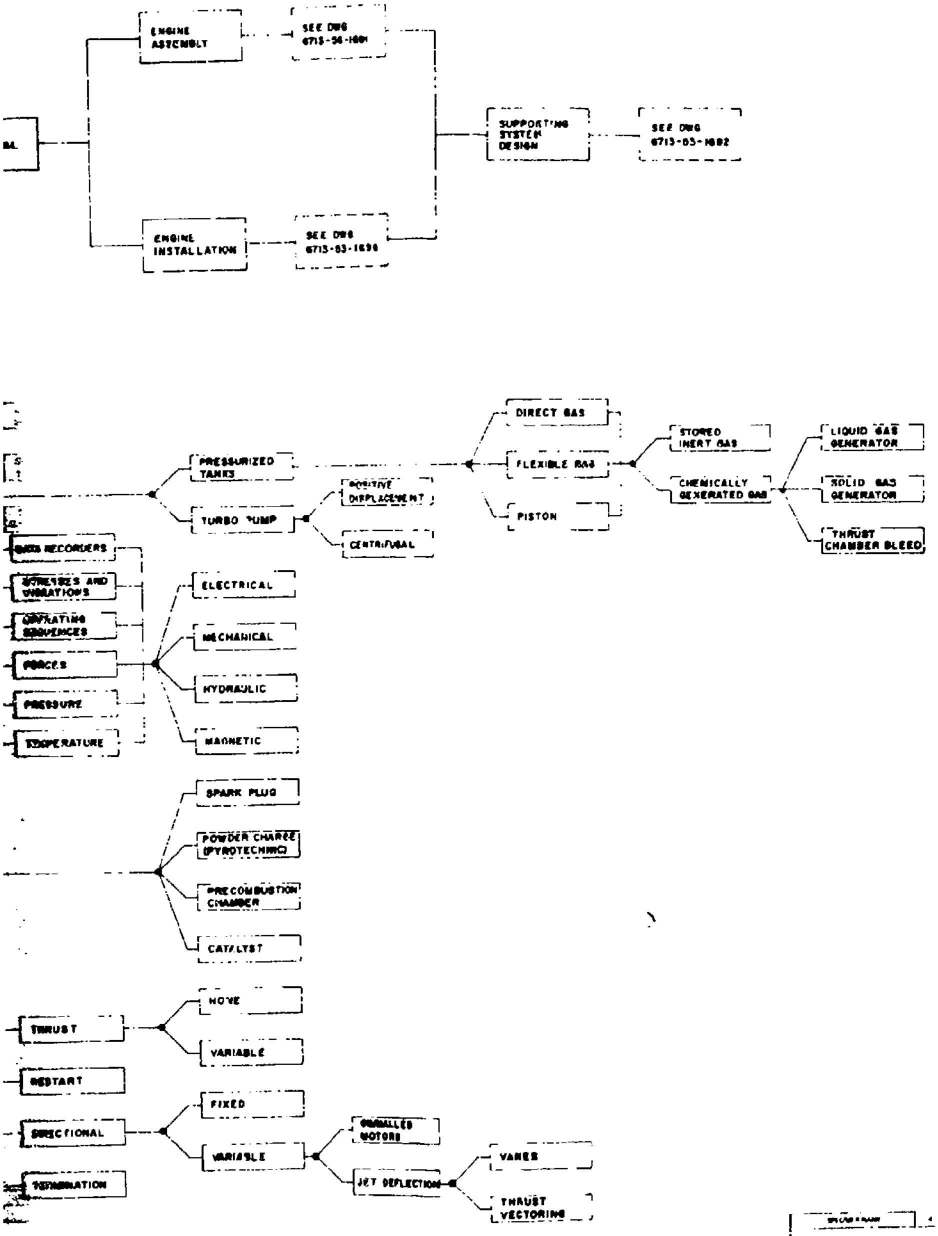
				SYSTEMS RESEARCH LABORATORIES INC
			J. McCOOL 3-17-71	DECISION TREE, PROPULSION- RECIPROCATING ENGINE
			R. MARKER 16 MAR 1971	
6713-10-37-1276713-10-37-1276				J 14590 6713-10-37-1275 C


PROPULSION
HYBRID
REQUIREMENTS
AIR BREATHING
NON-AIR BREATHING
ELECTRICAL ENGINE
NUCLEAR ENGINE
ROCKET ENGINE
SEE DWG 6713-10-37-1277
JET ENGINE
RECIPROCATING ENGINE
SEE DWG 6713-10-37-1275
TURBO
HYBRID
RAM JET
SINGLE ENGINE
MULTI-ENGINE
SINGLE STAGE
MULTI-STAGE


SINGLE STAGE
MULTI-STAGE
FIRST STAGE
SECOND STAGE
THIRD STAGE
BASIC MECHANICAL DESIGN
AIR INDUCTION SYSTEM
LATERAL
INWARD TURNING
OUTWARD TURNING
FIXED
VARIABLE GEOMETRY
TWO DIMENSIONAL
AXISYMMETRIC
VERT. RAMP
HORIZ. RAMP
BOUNDARY LAYER BLEED
NO BOUNDARY LAYER BLEED
POWER EXTRACTION
NO POWER EXTRACTION
COMBUSTION CHAMBER
SUBSONIC COMB
SUPERSONIC COMB
LOW SUBSONIC
HIGH SUBSONIC
EXHAUST NOZZLE
FIXED
VARIABLE
AIRFRAME INTEGRATION
SEE AEROSPACE VEHICLE DESIGN TREE, DWG NO 6713-53-1696
STRUCTUAL HOUSING
SKIN MATERIAL
INSULATION
LIQUID COOLING CHAMBERS


AEROSPACE GROUND EQUIPMENT
BASIC MECHANICAL DESIGN
ENGINE ASSEMBLY
SEE DWG 6713-56-1681
ENGINE INSTALLATION
SEE DWG. 6713-52-1686
SUPPORTING SYSTEM DESIGN
SEE DWG 6713-53-1692
POWER EXTRACTION
NO POWER EXTRACTION
AUXILIARY INLETS
NO AUXILIARY INLETS
SUPPORTING SYSTEM DESIGN
FUEL CONTROL
PRESSURIZED TANKS
TURBO PUMP
POSITIVE DISPLACEMENT
CENTRIFUGAL
DIRECT GAS
FLEXIBLE BAG
PISTON
STORED INERT GAS
CHEMICALLY GENERATED GAS
INSTRUMENTATION
DATA RECORDERS
STRESSES AND VIBRATIONS
OPERATING SEQUENCES
FORCES
PRESSURE
TEMPERATURE
ELECTRICAL
MECHANICAL
HYDRAULIC
MAGNETIC
IGNITION
SPARK PLUG
POWDER CHARGE (PYROTECHNIC)
PRECUMBUSTION CHAMBER
CATALYST
ENGINE CONTROL
THRUST
RESTART
DIRECTIONAL
TERMINATION
NONE
VARIABLE
FIXED
VARIABLE
GIMBALLED MOTORS
JET DEFLECTION
VANES
THRUST VECTORING

REVISED AND REDRAWN 4-19-72



LEGEND

FOR INTEGRATION

☐ REF. 6713-64-1941 SH. 4

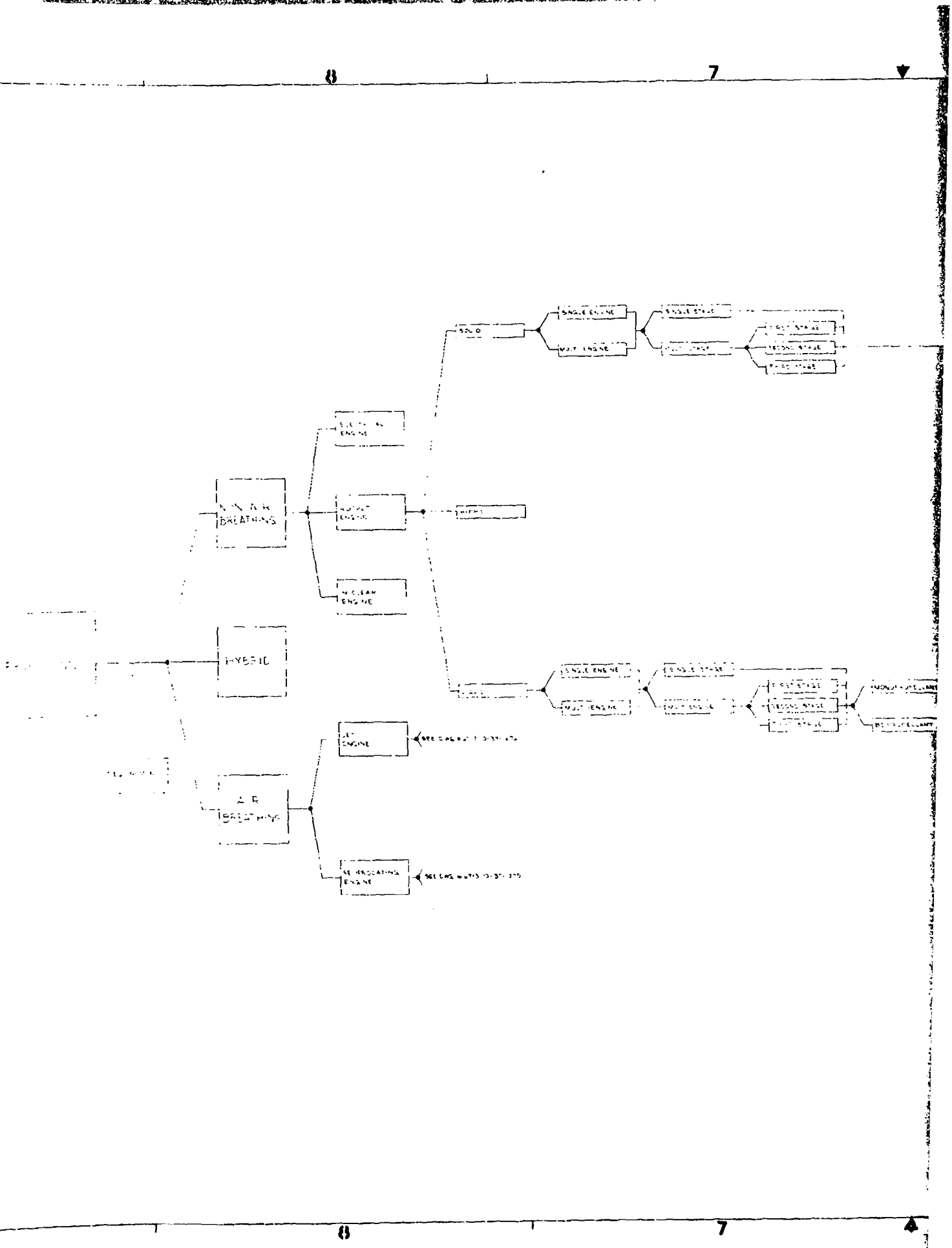
SYSTEMS RESEARCH LABORATORIES, INC.

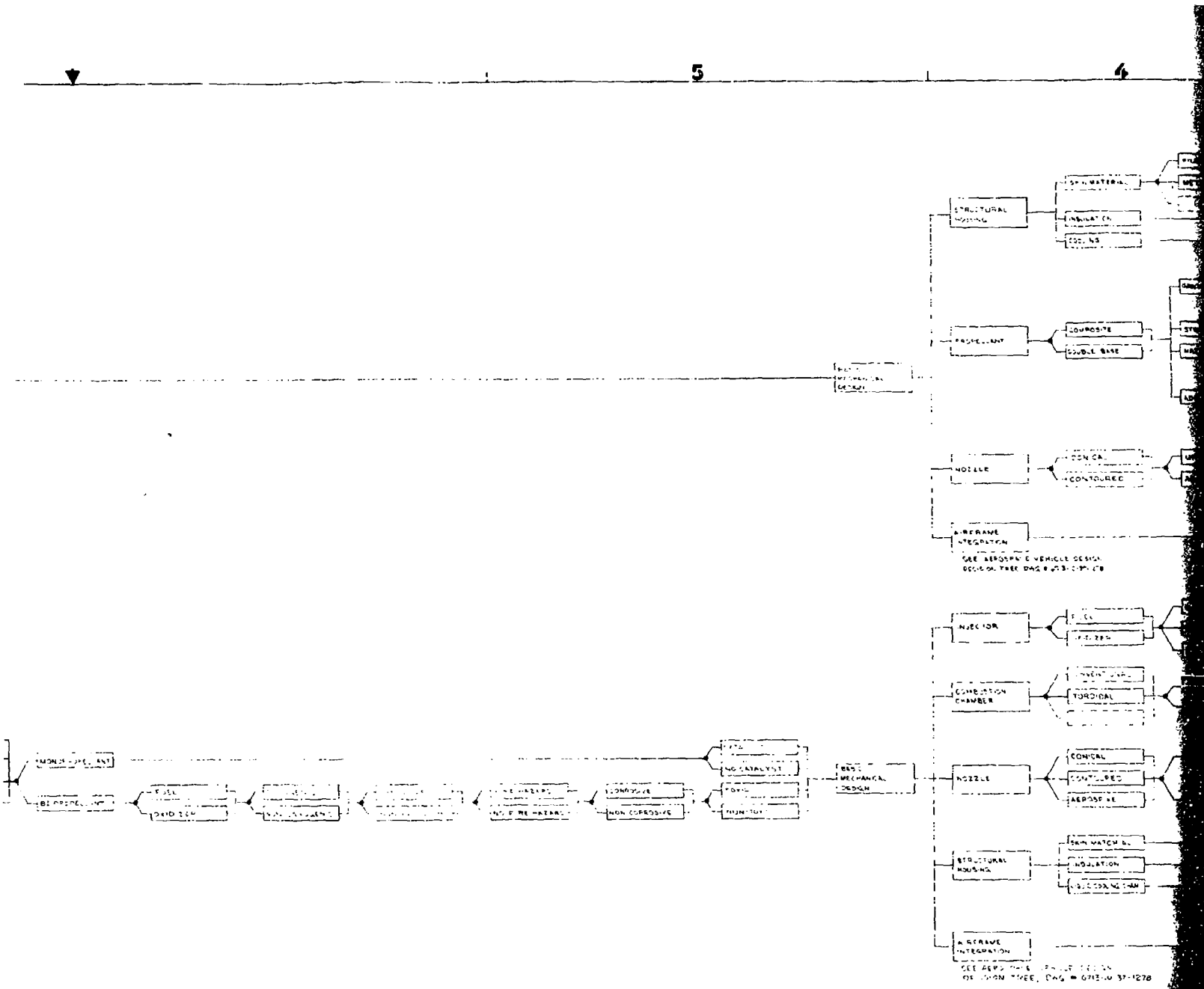
DRAWN R. MARKER

NEXT ASSY 6713-53-1694

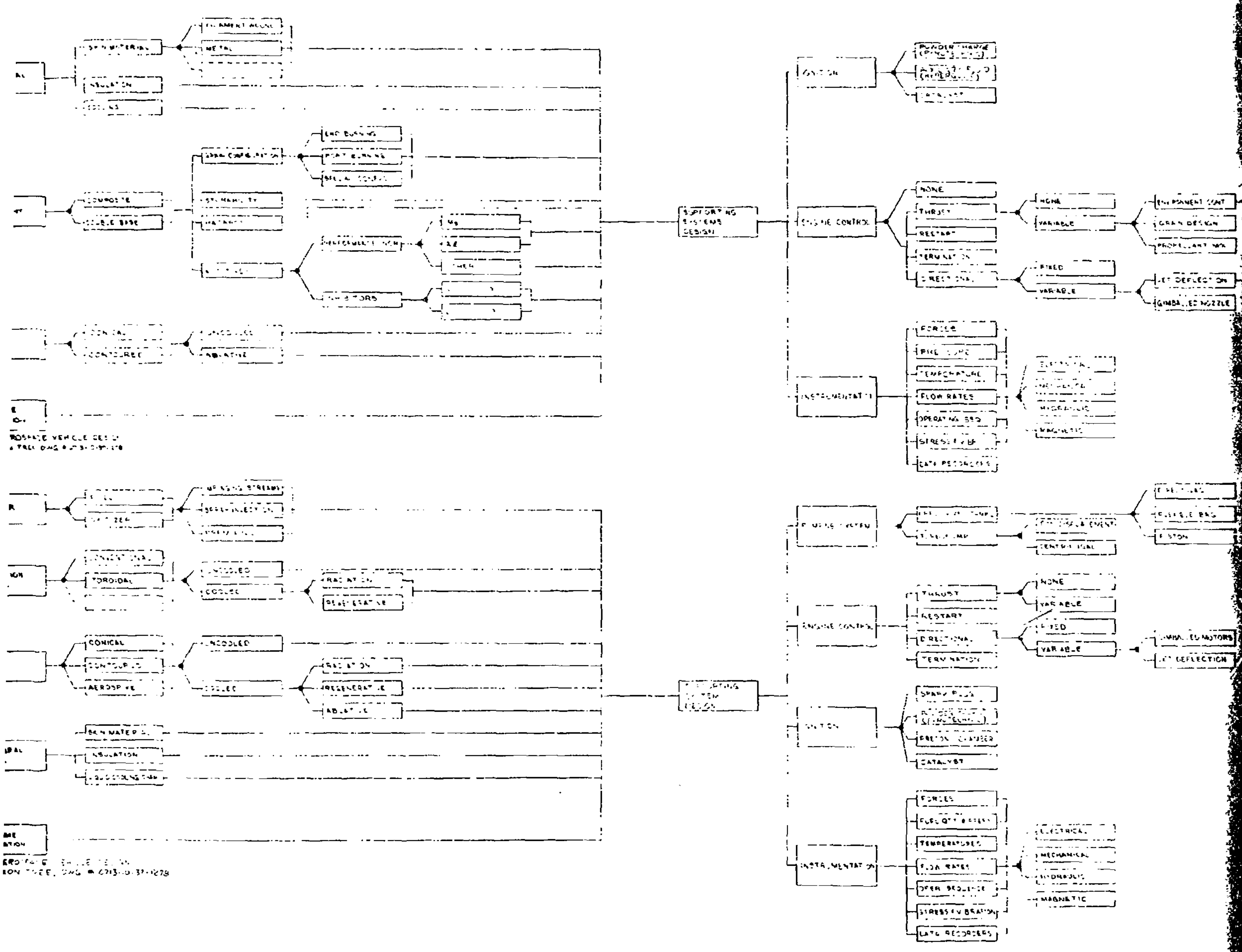
DECISION TREE
PROPULSION—
JET ENGINE

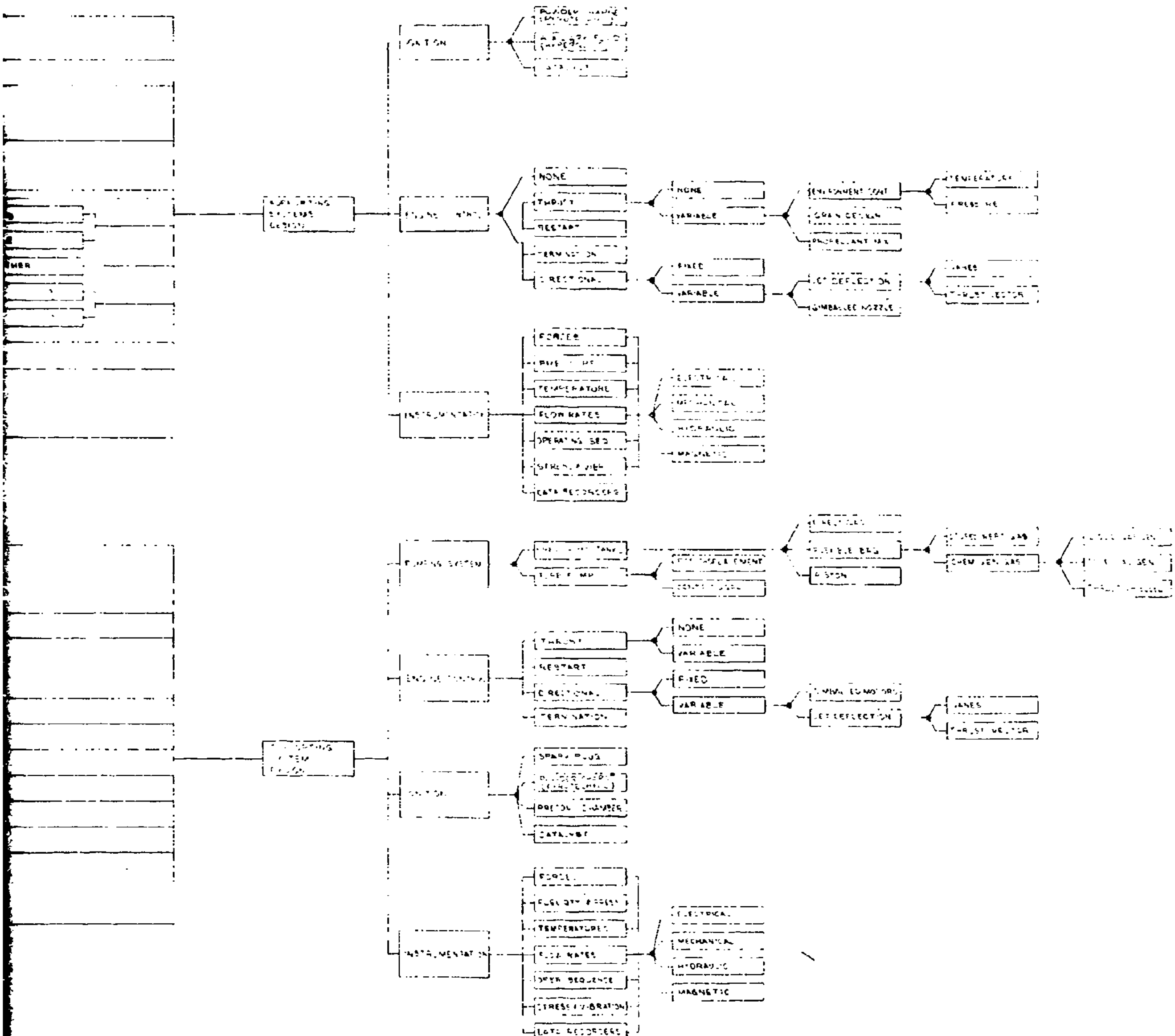
J 14690 6713-53-1695 A


8
7
D
C
B
A
AIR BREATHING
HYBRID
AIR BREATHING
SINGLE ENGINE
SINGLE ENGINE



6713-10-37-1277 | REV 1

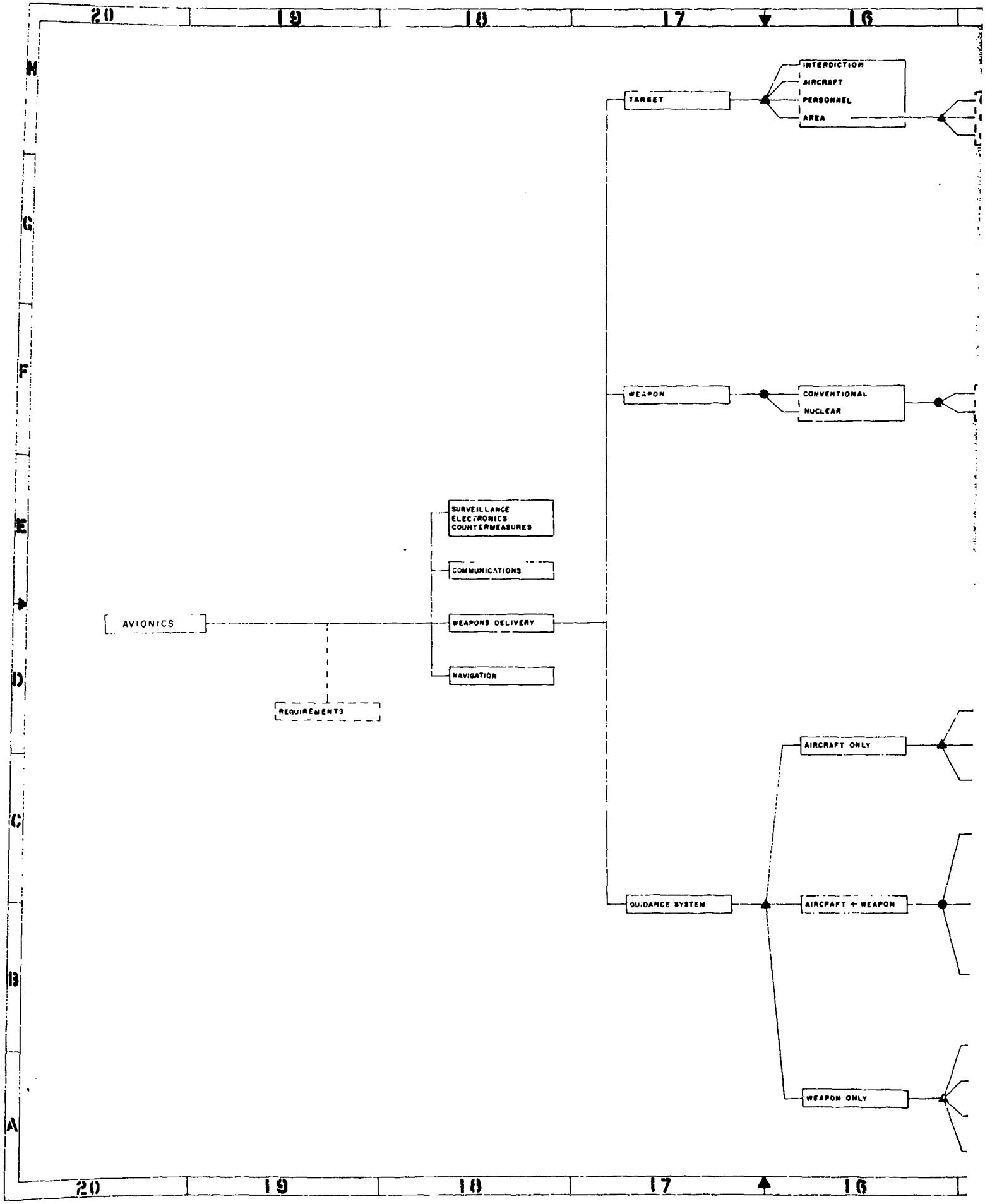

SUPPORTING SYSTEMS DESIGN
ENGINE CONTROL
NONE
THRUST
RESTART
TERMINATION
DIRECTIONAL
VARIABLE
FIXED
GRAIN DESIGN
PROPELLANT MIX
JET DEFLECTION
GIMBALLED NOZZLE
FORCES
TEMPERATURE
FLOW RATES
DATA RECORDERS
COMPOSITE
DOUBLE BASE
INHIBITORS
END BURNING
PORT BURNING
METAL
CONICAL
CONTOURED
UNCOOLED
ABLATIVE
TOROIDAL
COOLED
RADIATION
REGENERATIVE
AEROSPIKE
SKIN MATERIAL
INSULATION
SPARK PLUG
CATALYST
ELECTRICAL
MECHANICAL
HYDRAULIC
MAGNETIC
GIMBALLED MOTORS
PISTON
CENTRIFUGAL

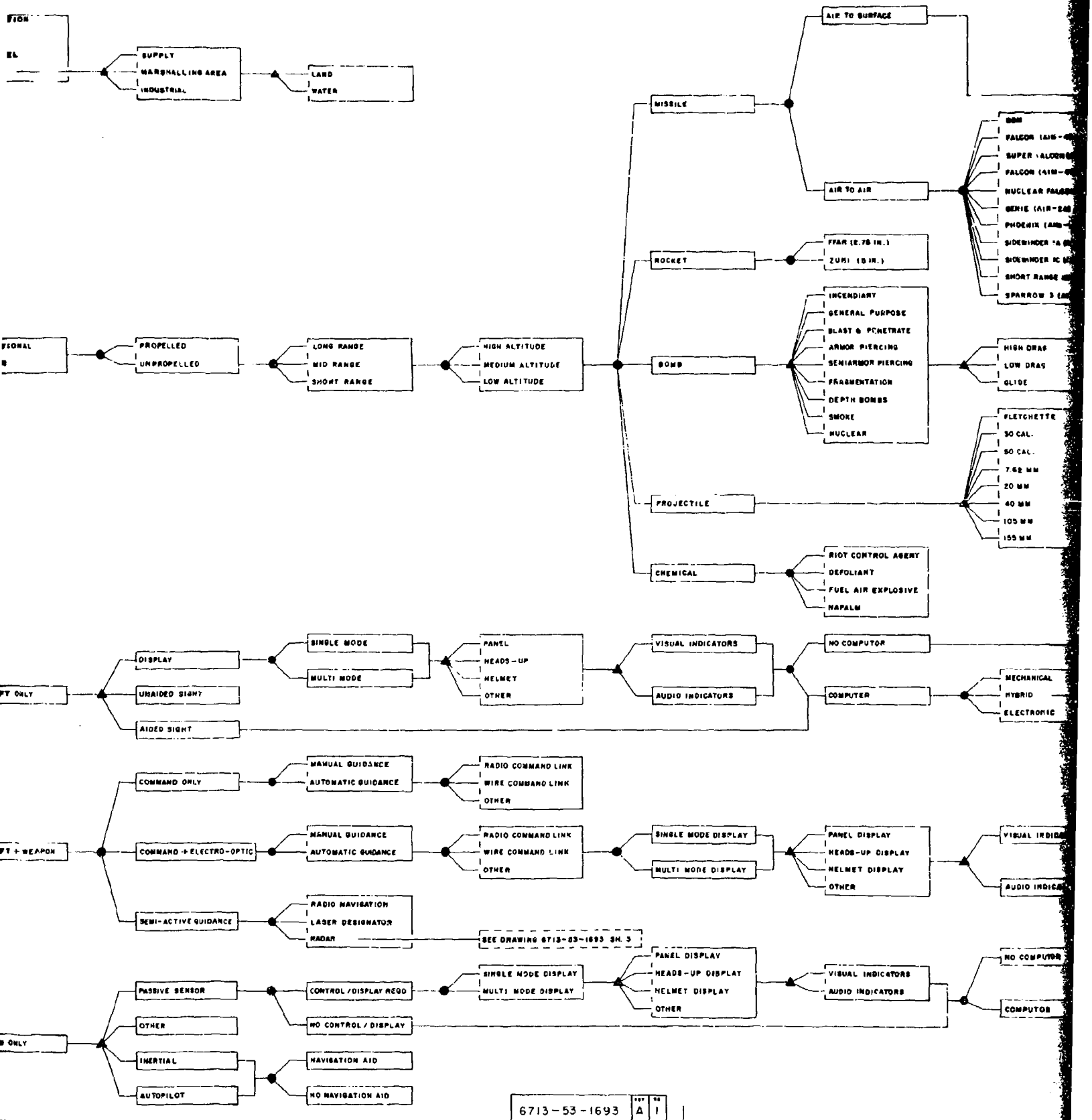


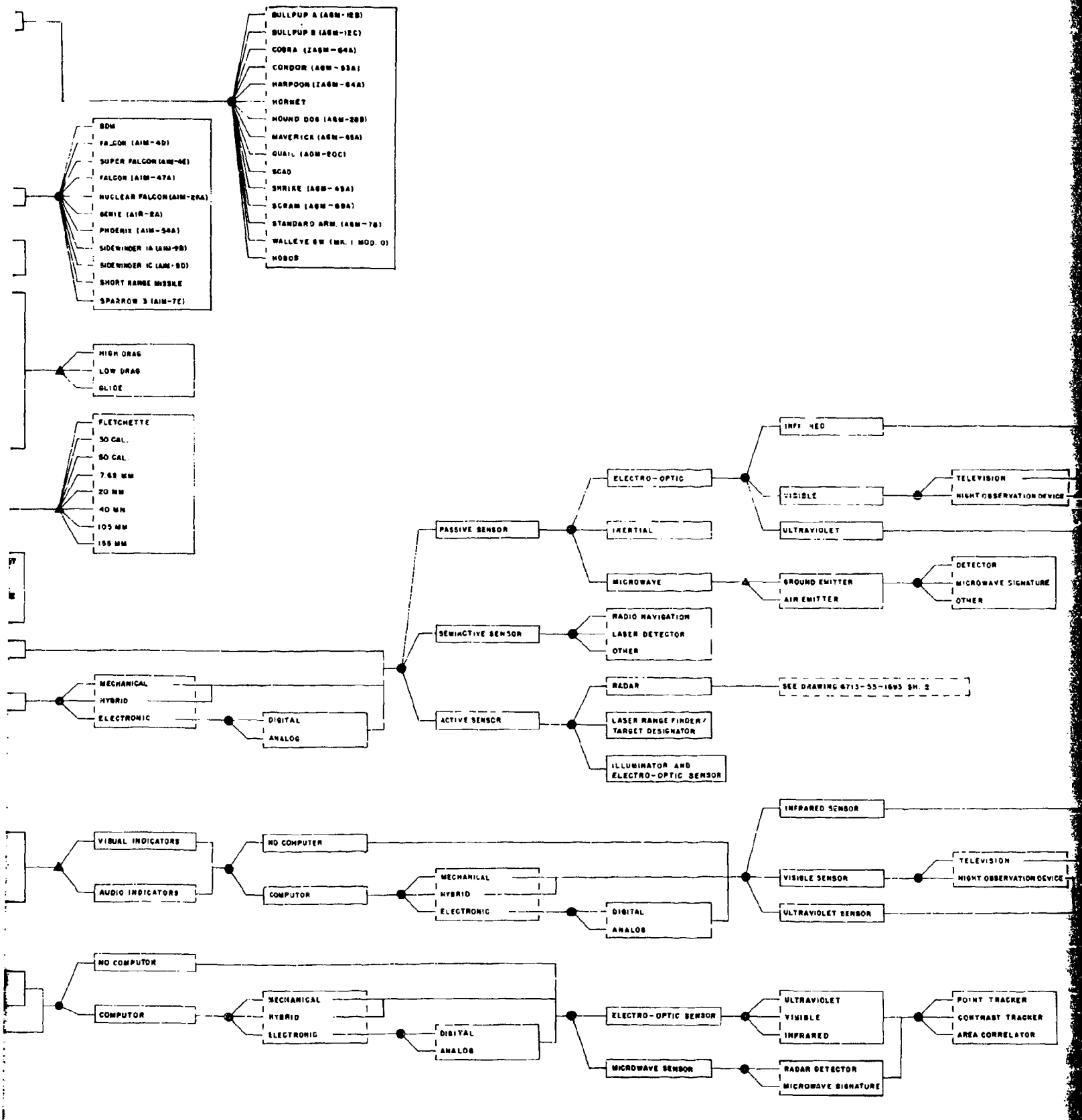
DECISION TREE, PROPULSION - ROCKET ENGINE

J MARTIN

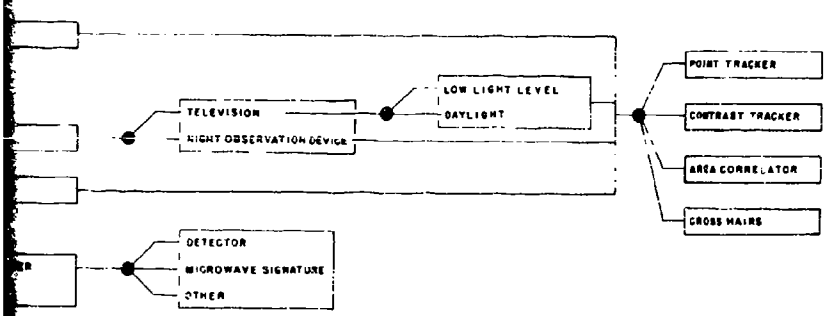
J 14590 6713-10-37-1277


20
19
18
17
16
H
G
F
E
D
C
B
A
AVIONICS
SURVEILLANCE ELECTRONICS COUNTERMEASURES
COMMUNICATIONS
WEAPONS DELIVERY
NAVIGATION
REQUIREMENTS
TARGET
INTERDICTION
AIRCRAFT
PERSONNEL
AREA
WEAPON
CONVENTIONAL
NUCLEAR
GUIDANCE SYSTEM
AIRCRAFT ONLY
AIRCRAFT + WEAPON
WEAPON ONLY

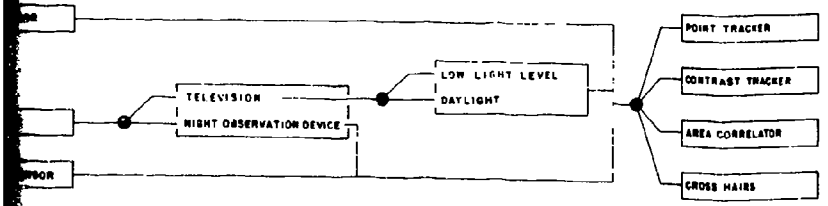

SUPPLY
MARSHALLING AREA
INDUSTRIAL
LAND
WATER
PROPELLED
UNPROPELLED
LONG RANGE
MID RANGE
SHORT RANGE
HIGH ALTITUDE
MEDIUM ALTITUDE
LOW ALTITUDE
MISSILE
ROCKET
BOMB
PROJECTILE
CHEMICAL
AIR TO SURFACE
AIR TO AIR
FFAR (2.75 IN.)
ZUNI (5 IN.)
INCENDIARY
GENERAL PURPOSE
BLAST & PENETRATE
ARMOR PIERCING
SEMIARMOR PIERCING
FRAGMENTATION
DEPTH BOMBS
SMOKE
NUCLEAR
HIGH DRAG
LOW DRAG
GLIDE
FLETCHETTE
.30 CAL.
.50 CAL.
7.62 MM
20 MM
40 MM
105 MM
155 MM
RIOT CONTROL AGENT
DEFOLIANT
FUEL AIR EXPLOSIVE
NAPALM
DISPLAY
UNAIDED SIGHT
AIDED SIGHT
SINGLE MODE
MULTI MODE
PANEL
HEADS-UP
HELMET
OTHER
VISUAL INDICATORS
AUDIO INDICATORS
NO COMPUTOR
COMPUTER
MECHANICAL
HYBRID
ELECTRONIC
COMMAND ONLY
COMMAND + ELECTRO-OPTIC
SEMI-ACTIVE GUIDANCE
MANUAL GUIDANCE
AUTOMATIC GUIDANCE
RADIO COMMAND LINK
WIRE COMMAND LINK
OTHER
RADIO NAVIGATION
LASER DESIGNATOR
RADAR
SEE DRAWING 6713-53-1693 SH. 3
SINGLE MODE DISPLAY
MULTI MODE DISPLAY
PANEL DISPLAY
HEADS-UP DISPLAY
HELMET DISPLAY
OTHER
PASSIVE SENSOR
OTHER
INERTIAL
AUTOPILOT
CONTROL / DISPLAY REQD
NO CONTROL / DISPLAY
NAVIGATION AID
NO NAVIGATION AID

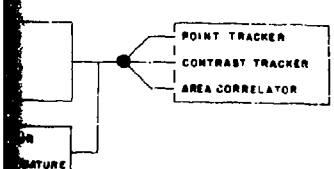

BULLPUP A (AGM-12B)
BULLPUP B (AGM-12C)
COBRA (ZAGM-64A)
CONDOR (AGM-53A)
HARPOON (ZAGM-84A)
HORNET
HOUND DOG (AGM-28B)
MAVERICK (AGM-65A)
QUAIL (ADM-20C)
SCAD
SHRIKE (AGM-45A)
SCRAM (AGM-69A)
STANDARD ARM. (AGM-78)
WALLEYE GW (MK. 1 MOD. 0)
HOBOS
BDM
FALCON (AIM-4D)
SUPER FALCON (AIM-4E)
FALCON (AIM-47A)
NUCLEAR FALCON (AIM-26A)
GENIE (AIR-2A)
PHOENIX (AIM-54A)
SIDEWINDER IA (AIM-9B)
SIDEWINDER IC (AIM-9D)
SHORT RANGE MISSILE
SPARROW 3 (AIM-7E)
HIGH DRAG
LOW DRAG
GLIDE
FLETCHETTE
30 CAL.
50 CAL.
7.62 MM
20 MM
40 MM
105 MM
155 MM
MECHANICAL
HYBRID
ELECTRONIC
DIGITAL
ANALOG
PASSIVE SENSOR
SEMIACTIVE SENSOR
ACTIVE SENSOR
ELECTRO-OPTIC
INERTIAL
MICROWAVE
INFRARED
VISIBLE
ULTRAVIOLET
TELEVISION
NIGHT OBSERVATION DEVICE
GROUND EMITTER
AIR EMITTER
DETECTOR
MICROWAVE SIGNATURE
OTHER
RADIO NAVIGATION
LASER DETECTOR
OTHER
RADAR
SEE DRAWING 6713-55-1693 SH. 2
LASER RANGE FINDER/ TARGET DESIGNATOR
ILLUMINATOR AND ELECTRO-OPTIC SENSOR
VISUAL INDICATORS
AUDIO INDICATORS
NO COMPUTER
COMPUTOR
MECHANICAL
HYBRID
ELECTRONIC
DIGITAL
ANALOG
INFRARED SENSOR
VISIBLE SENSOR
ULTRAVIOLET SENSOR
TELEVISION
NIGHT OBSERVATION DEVICE
NO COMPUTOR
COMPUTOR
MECHANICAL
HYBRID
ELECTRONIC
DIGITAL
ANALOG
ELECTRO-OPTIC SENSOR
MICROWAVE SENSOR
ULTRAVIOLET
VISIBLE
INFRARED
RADAR DETECTOR
MICROWAVE SIGNATURE
POINT TRACKER
CONTRAST TRACKER
AREA CORRELATOR

REVISIONS			
ZONE	LTR	DESCRIPTION	
	A	REVISED AND REDRAWN	



6713-53-1693 SH. 2





NOTES
1. PRIORITY OF DECISIONS IN THE USE OF THIS TREE SHOULD BE
   AND 20 TO 1.
2. THIS STUDY DID NOT INCLUDE ANY ANALYSIS OF GROUND CONTROL

SPECIFIED CLASS	4	3	2	1	QTY	PART NO.	CODE IDENT	DESCRIPTION
						PARTS LIST		

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS ± 1/32
ALL SURFACES ✓
MATERIAL
FINISH

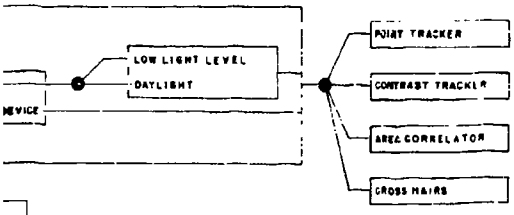
	SIGNATURE	DATE
APPROVED		
CHECKED		
DRAWN	DUCKNER	2-14-78
CONTRACT NO.		
GOVT PROJECT APPROVAL		
GOVT ACTIVITY APPROVAL		

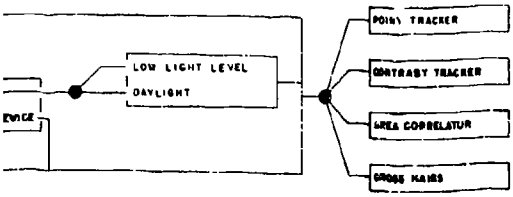
DECISION TREE
WEAPONS DEL

6713-53-1694		SIZE	CODE IDENT NO.
NEXT ASSY	USED ON	J	14590
APPLICATION		SCALE NONE	

6713-53-1693 REV A SH 1

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED AND REDRAWN	9-27-72	BUCKNER





NOTES
1. PRIORITY OF DECISIONS IN THE USE OF THIS TREE SHOULD BE FROM H TO A AND 20 TO 1
2. THIS STUDY DID NOT INCLUDE ANY ANALYSIS OF GROUND CONTROL OF WEAPONS

SPECIFIED NAME	4	3	2	1	QTY	PART NO.	CODE IDENT	DESCRIPTION	ITEM NO

PARTS LIST

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
ALL SURFACES ✓

MATERIAL
FINISH
CHECKED
DRAWN BUCKNER 9-16-72
CONTRACT NO.
GOVT ACTIVITY APPROVAL

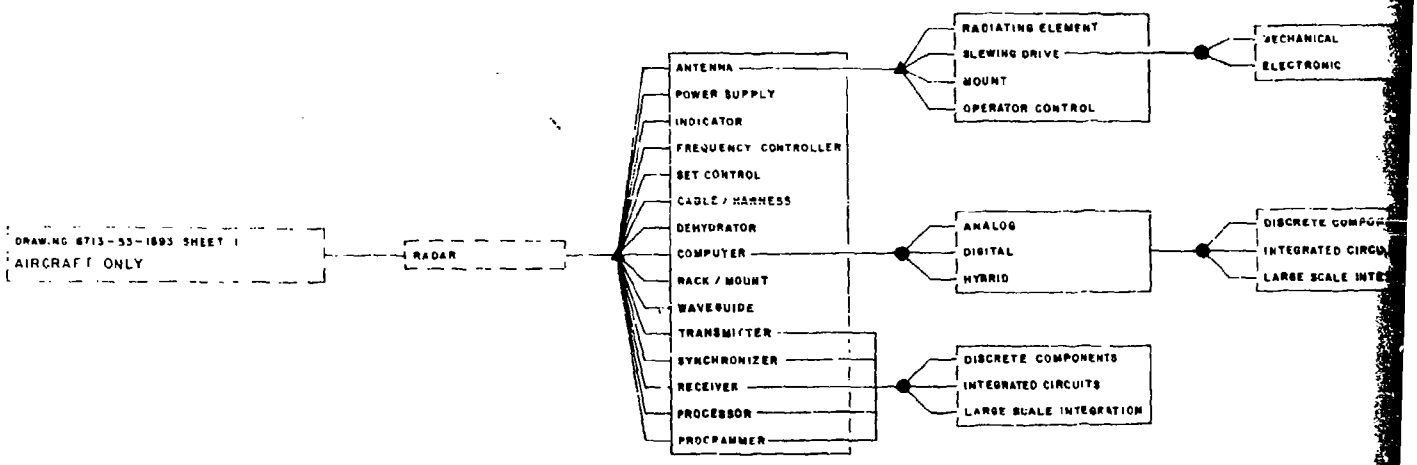
SYSTEMS RESEARCH LABORATORIES, INC.

DECISION TREE — AVIONICS WEAPONS DELIVERY

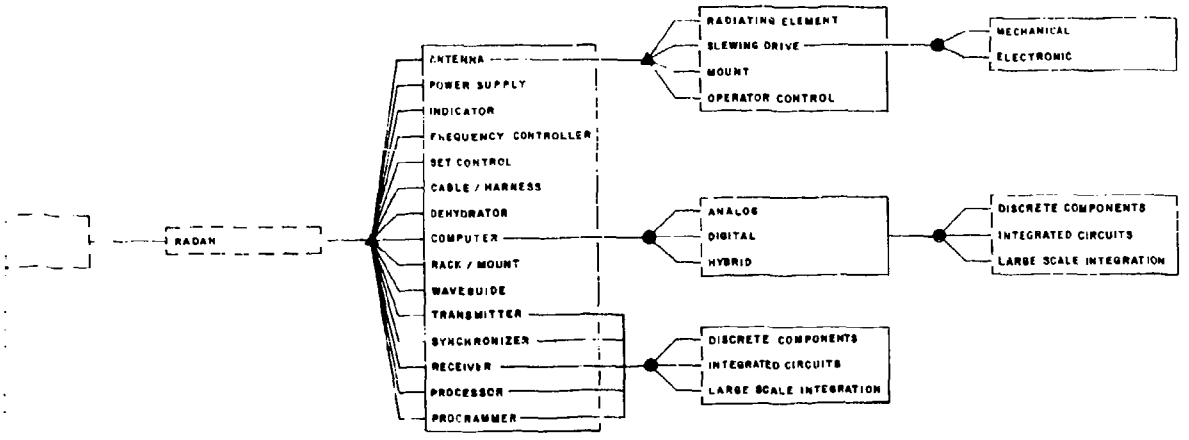
CODE IDENT NO	DRAWING NO	REV
J 14590	6713-53-1693	A

SCALE NONE

6713-53-1693 | A | 1


DRAWING 6713-55-1893 SHEET 1
AIRCRAFT ONLY
RADAR
ANTENNA
POWER SUPPLY
INDICATOR
FREQUENCY CONTROLLER
SET CONTROL
CABLE / HARNESS
DEHYDRATOR
COMPUTER
RACK / MOUNT
WAVEGUIDE
TRANSMITTER
SYNCHRONIZER
RECEIVER
PROCESSOR
PROGRAMMER
RADIATING ELEMENT
SLEWING DRIVE
MOUNT
OPERATOR CONTROL
MECHANICAL
ELECTRONIC
ANALOG
DIGITAL
HYBRID
DISCRETE COMPONENTS
INTEGRATED CIRCUITS
LARGE SCALE INTEGRATION

ZONE	LTR	DESCRIPTION	DATE	APPROVED
	A	REVISED AND REDRAWN	10-10-72	BUCKNER



PROGRAM NAME	4	3	2	1	QTY.	PARTS LIST							
67B-53-1693													
NEXT ASSY	USED ON												
APPLICATION													

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
ALL SURFACES ✓
MATERIAL
FINISH

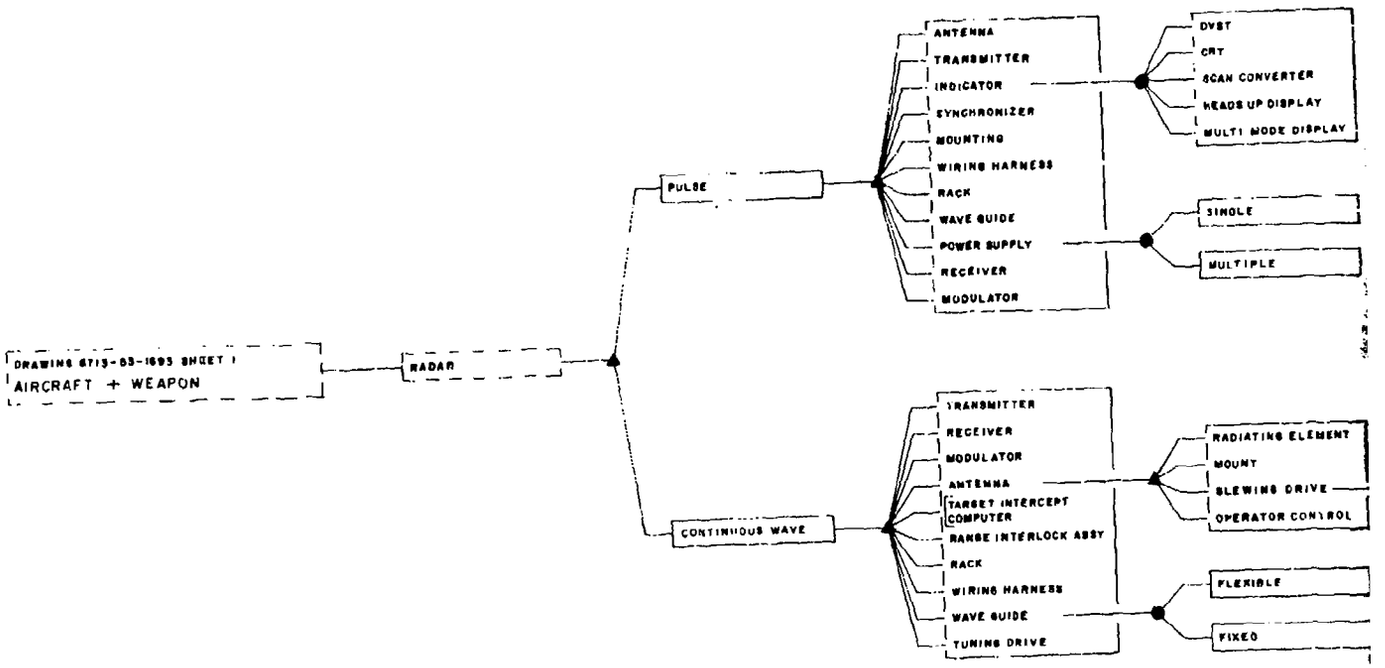
	SIGNATURE	DATE
APPROVED		
DESIGN	BUCKNER	12-14-71
DRAWN		
CHECKED		
ENGR APPROVAL		
MFG APPROVAL		
CUST APPROVAL		

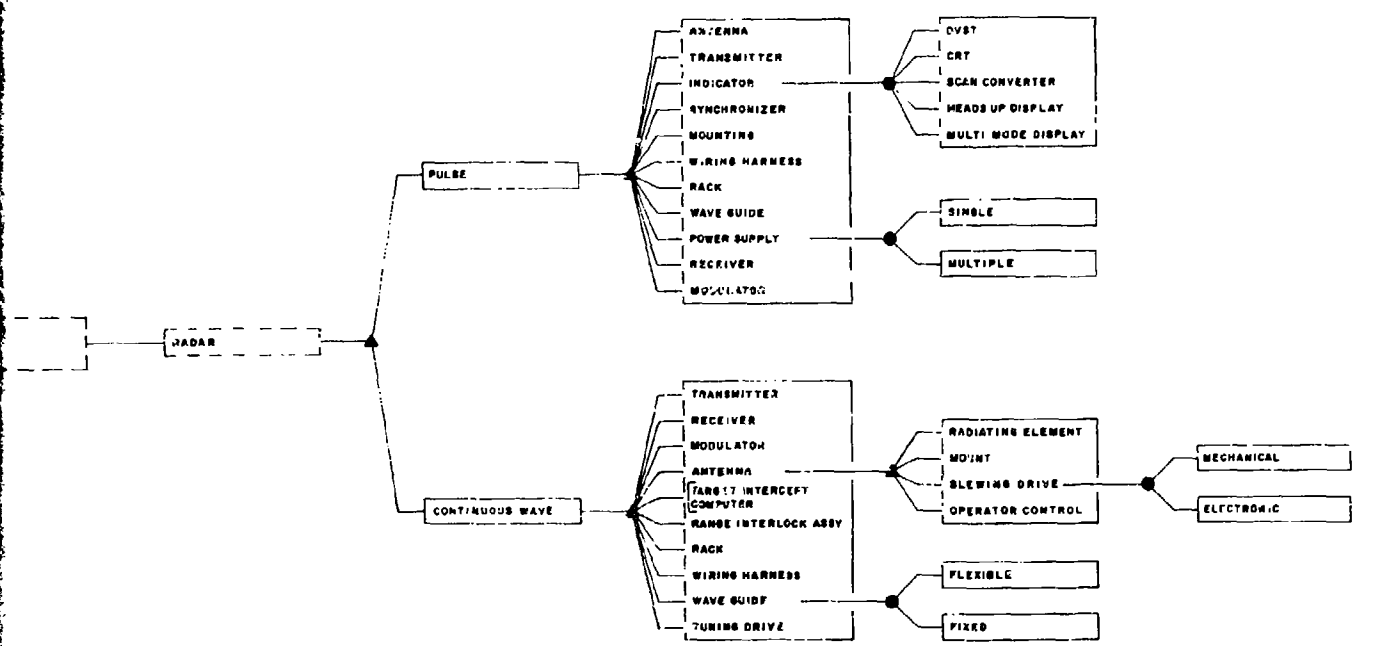
DISTRICT NO.
MFG PROJECT APPROVAL
GOVT ACTIVITY APPROVAL

DECISION TREE – AVIONICS WEAPONS DELIVERY

SIZE	CODE IDENT NO.	DWG NO.	REV
E	14590	67.3-53-1693	A

NEXT ASSY NONE
SCALE NONE
SHEET 2 OF 2


DRAWING 6713-03-1693 SHEET 1
AIRCRAFT + WEAPON
RADAR
PULSE
CONTINUOUS WAVE
ANTENNA
TRANSMITTER
INDICATOR
SYNCHRONIZER
MOUNTING
WIRING HARNESS
RACK
WAVE GUIDE
POWER SUPPLY
RECEIVER
MODULATOR
DVST
CRT
SCAN CONVERTER
HEADS UP DISPLAY
MULTI MODE DISPLAY
SINGLE
MULTIPLE
TRANSMITTER
RECEIVER
MODULATOR
ANTENNA
TARGET INTERCEPT COMPUTER
RANGE INTERLOCK ASSY
RACK
WIRING HARNESS
WAVE GUIDE
TUNING DRIVE
RADIATING ELEMENT
MOUNT
SLEWING DRIVE
OPERATOR CONTROL
FLEXIBLE
FIXED



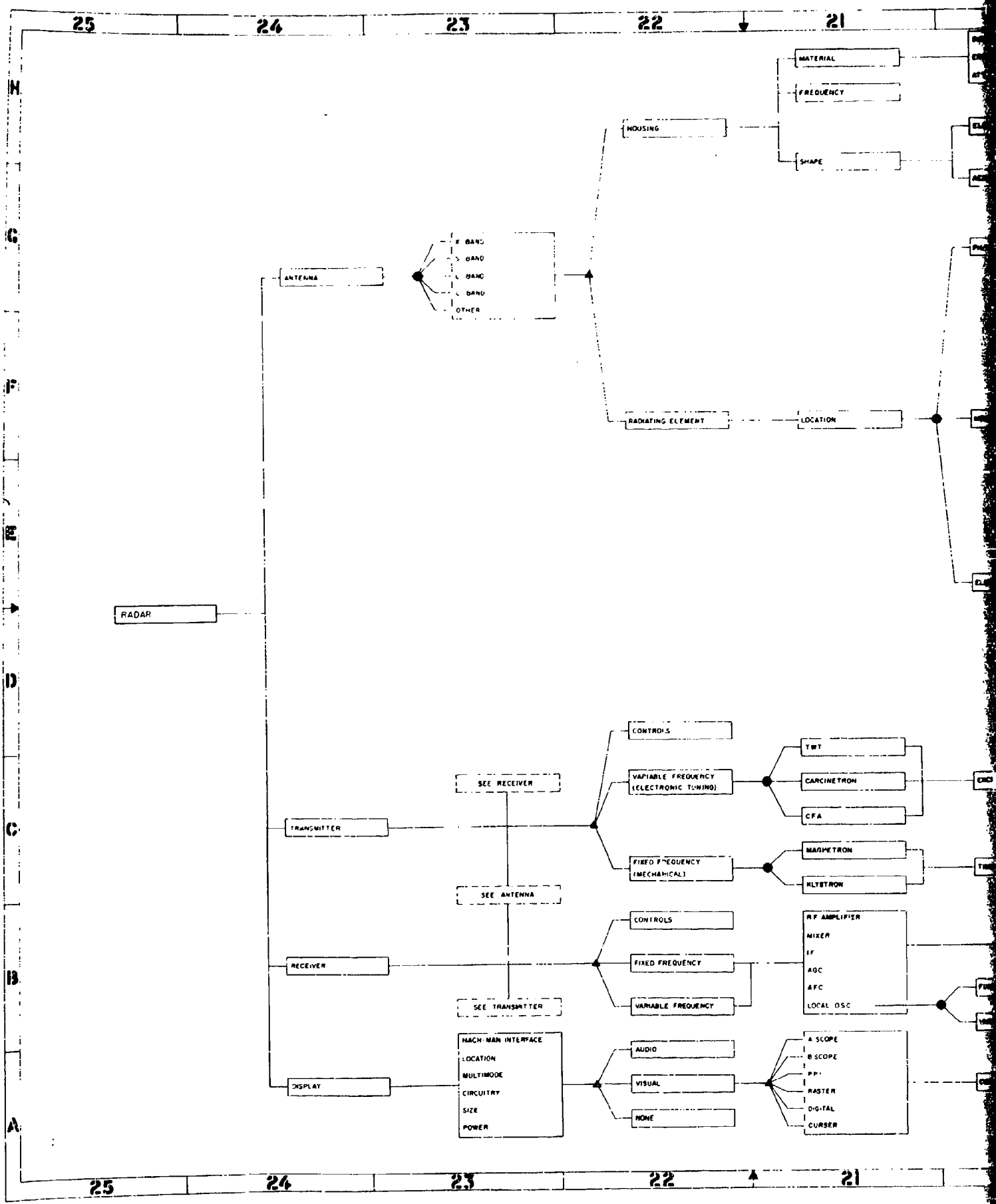
	A	REVISED AND REDRAWN	10-6-72 BUCKNER

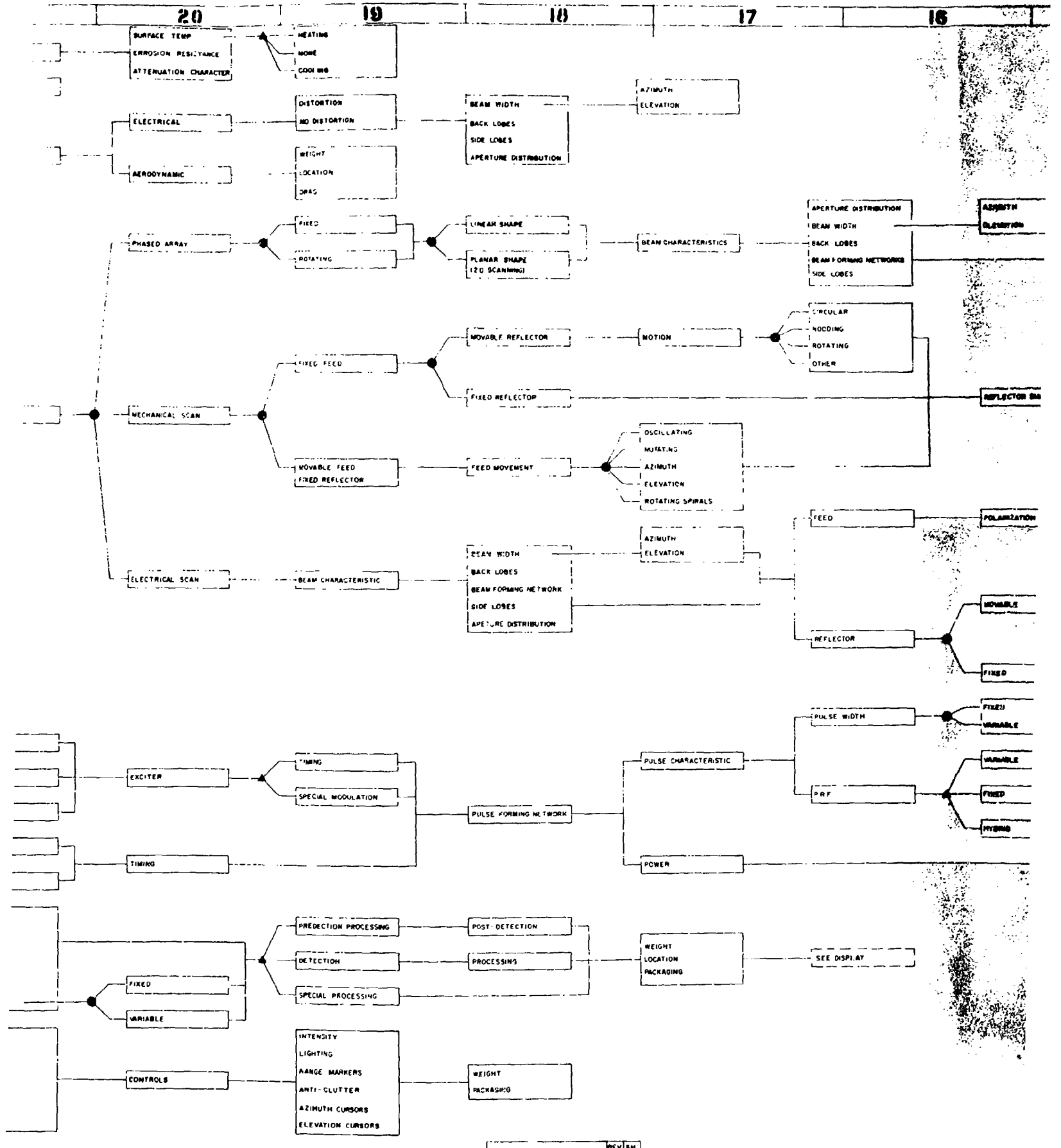
DECISION TREE — AVIONICS WEAPONS DELIVERY

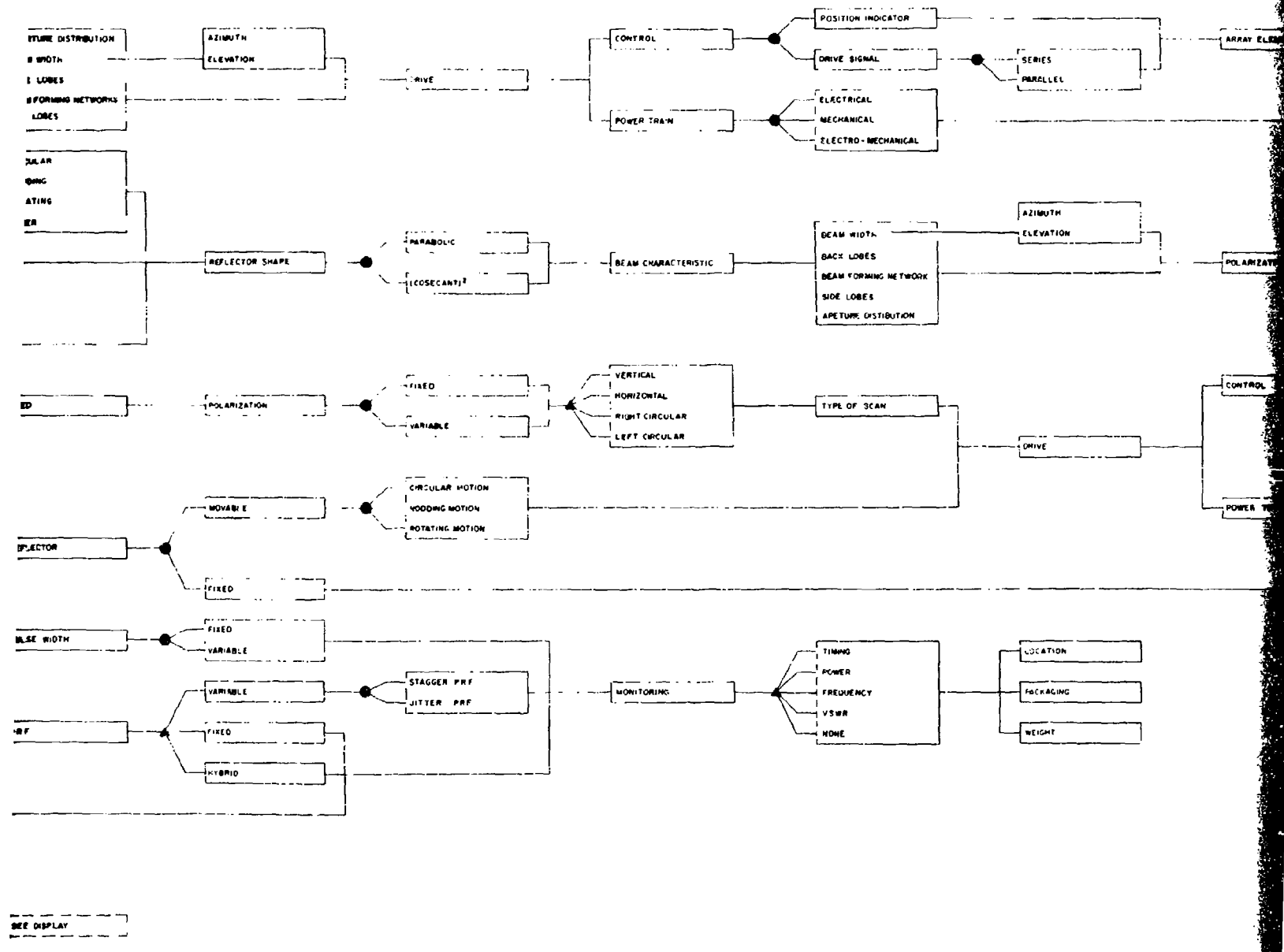
BUCKNER 8-16-71

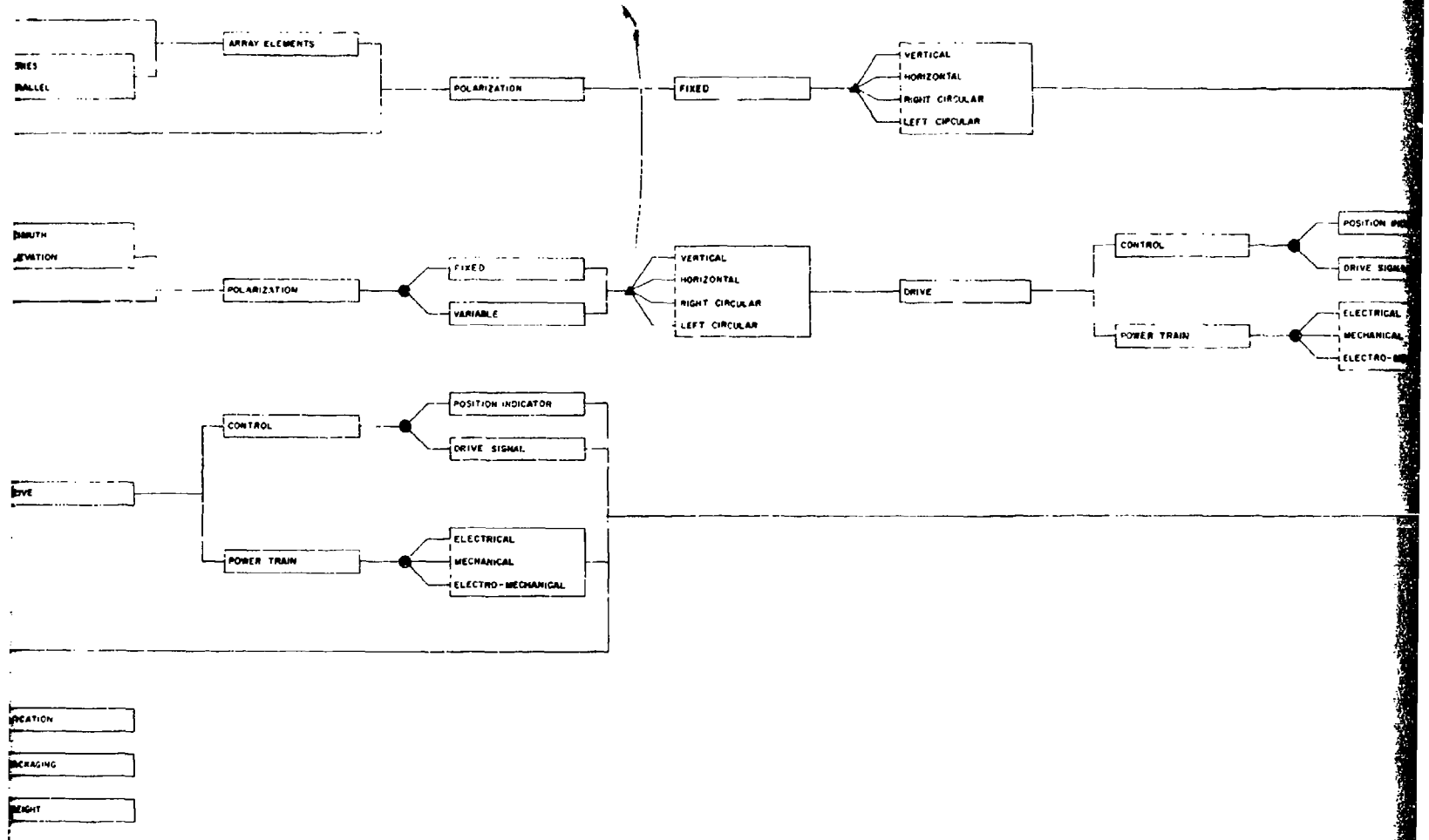
6713-53-1693

E 14590 6713-53-1693 A


25
24
23
22
21
H
G
F
E
D
C
B
A
RADAR
ANTENNA
X BAND
S BAND
L BAND
C BAND
OTHER
HOUSING
MATERIAL
FREQUENCY
SHAPE
RADIATING ELEMENT
LOCATION
TRANSMITTER
SEE RECEIVER
CONTROLS
VARIABLE FREQUENCY (ELECTRONIC TUNING)
TWT
CARCINETRON
CFA
FIXED FREQUENCY (MECHANICAL)
MAGNETRON
KLYSTRON
SEE ANTENNA
RECEIVER
CONTROLS
FIXED FREQUENCY
VARIABLE FREQUENCY
RF AMPLIFIER
MIXER
IF
AGC
AFC
LOCAL OSC
SEE TRANSMITTER
DISPLAY
M&CH-MAN INTERFACE
LOCATION
MULTIMODE
CIRCUITRY
SIZE
POWER
AUDIO
VISUAL
NONE
A SCOPE
B SCOPE
PPI
RASTER
DIGITAL
CURSER


20
19
18
17
16
SURFACE TEMP
EROSION RESISTANCE
ATTENUATION CHARACTER
HEATING
NONE
COOLING
ELECTRICAL
AERODYNAMIC
DISTORTION
NO DISTORTION
WEIGHT
LOCATION
DRAG
BEAM WIDTH
BACK LOBES
SIDE LOBES
APERTURE DISTRIBUTION
AZIMUTH
ELEVATION
PHASED ARRAY
FIXED
ROTATING
LINEAR SHAPE
PLANAR SHAPE
(2D SCANning)
BEAM CHARACTERISTICS
APERTURE DISTRIBUTION
BEAM WIDTH
BACK LOBES
BEAM FORMING NETWORKS
SIDE LOBES
MECHANICAL SCAN
FIXED FEED
MOVABLE REFLECTOR
FIXED REFLECTOR
MOTION
CIRCULAR
NODDING
ROTATING
OTHER
MOVABLE FEED
FIXED REFLECTOR
FEED MOVEMENT
OSCILLATING
NUTATING
AZIMUTH
ELEVATION
ROTATING SPIRALS
ELECTRICAL SCAN
BEAM CHARACTERISTIC
BEAM WIDTH
BACK LOBES
BEAM FORMING NETWORK
SIDE LOBES
APERTURE DISTRIBUTION
AZIMUTH
ELEVATION
FEED
POLARIZATION
REFLECTOR
MOVABLE
FIXED
EXCITER
TIMING
SPECIAL MODULATION
TIMING
PULSE FORMING NETWORK
PULSE CHARACTERISTIC
PULSE WIDTH
PRF
POWER
FIXED
VARIABLE
FIXED
VARIABLE
HYBRID
PREDECTION PROCESSING
DETECTION
SPECIAL PROCESSING
POST-DETECTION
PROCESSING
WEIGHT
LOCATION
PACKAGING
SEE DISPLAY
FIXED
VARIABLE
CONTROLS
INTENSITY
LIGHTING
RANGE MARKERS
ANTI-CLUTTER
AZIMUTH CURSORS
ELEVATION CURSORS
WEIGHT
PACKAGING
6713-64-1945
REV A
SH 1


AZIMUTH
ELEVATION
DRIVE
CONTROL
POSITION INDICATOR
DRIVE SIGNAL
SERIES
PARALLEL
POWER TRAIN
ELECTRICAL
MECHANICAL
ELECTRO-MECHANICAL
REFLECTOR SHAPE
PARABOLIC
(COSECANT)²
BEAM CHARACTERISTIC
BEAM WIDTH
BACK LOBES
BEAM FORMING NETWORK
SIDE LOBES
APETURE DISTIBUTION
AZIMUTH
ELEVATION
POLARIZATION
FIXED
VARIABLE
VERTICAL
HORIZONTAL
RIGHT CIRCULAR
LEFT CIRCULAR
TYPE OF SCAN
DRIVE
CONTROL
MOVABLE
CIRCULAR MOTION
NODDING MOTION
ROTATING MOTION
FIXED
FIXED
VARIABLE
VARIABLE
STAGGER PRF
JITTER PRF
FIXED
HYBRID
MONITORING
TIMING
POWER
FREQUENCY
VSWR
NONE
LOCATION
PACKAGING
WEIGHT
SEE DISPLAY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VERTICAL
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VARIABLE
VERTICAL
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RIGHT CIRCULAR
LEFT CIRCULAR
DRIVE
CONTROL
POWER TRAIN
ELECTRICAL
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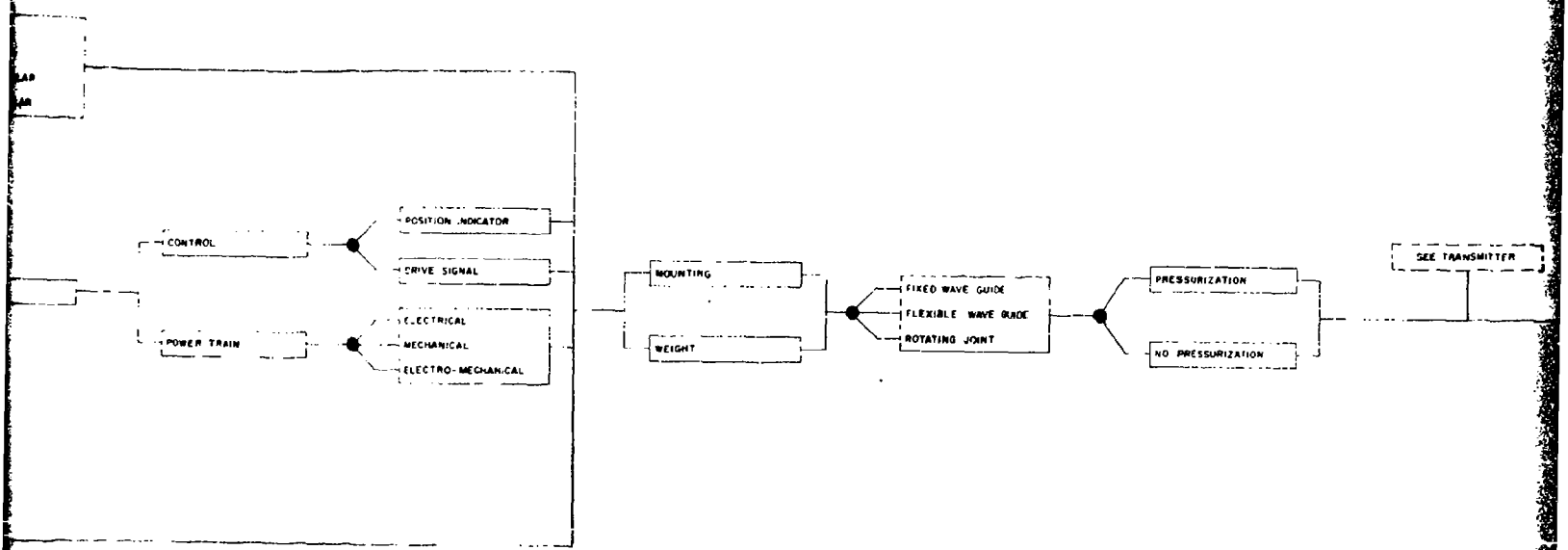
CONTROL
POSITION INDICATOR
DRIVE SIGNAL
POWER TRAIN
ELECTRICAL
MECHANICAL
ELECTRO-MECHANICAL


CONTROL
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DRIVE SIGNAL
POWER TRAIN
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MECHANICAL
ELECTRO-MECHANICAL
MOUNTING
WEIGHT
FIXED WAVE GUIDE
FLEXIBLE WAVE GUIDE
ROTATING JOINT
PRESSURIZATION
NO PRESSURIZATION
SEE TRANSMITTER

REVISIONS				
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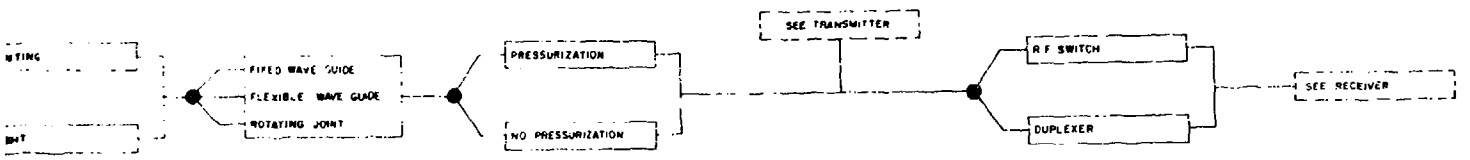

PARTS LIST								
BRACKET & PANEL	4	3	2	1	QTY	PART NO.	CODE IDENT	DESCRIPTION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES
FRACTIONS ± 1/32
ANGLES ± 0°
.XX ± .01
.XXX ± .005
ALL SURFACES ✓
MATERIAL
FINISH
NEXT ASSY | USED ON
APPLICATION

	SIGNATURE	DATE
APPROVED		
CHECKED		
DRAWN	R H OTTO	15 NOV 72
CONTRACT NO.		
SRL PROJECT APPROVAL		
GOVT ACTIVITY APPROVAL		

SYSTEMS RESEARCH LABORATORIES, INC.
2801 WEST DAYTON ROAD DAYTON, OHIO 45439

DECISION TREE – AVIONICS - RADAR

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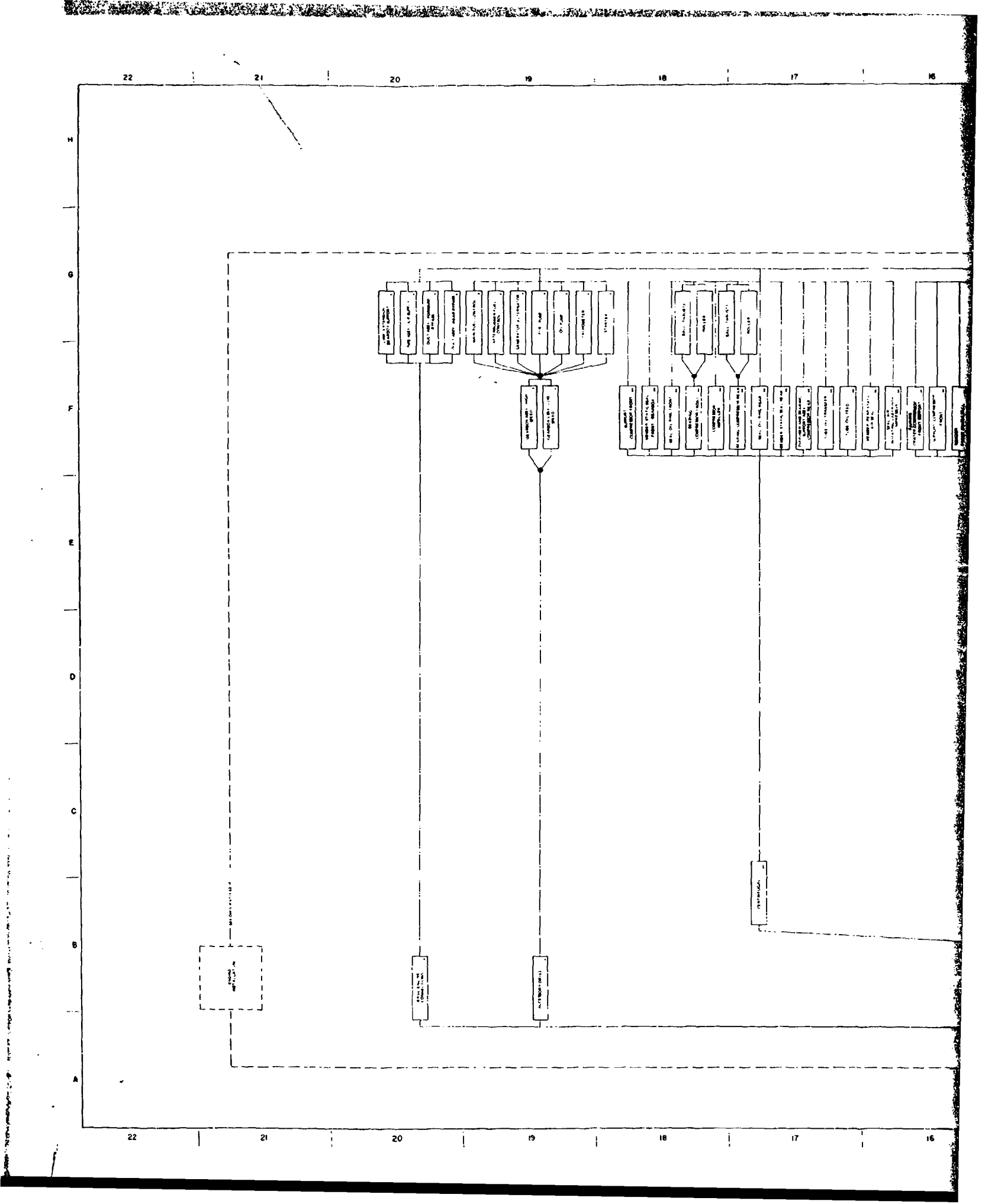
SCALE NONE | SHEET 1 OF 1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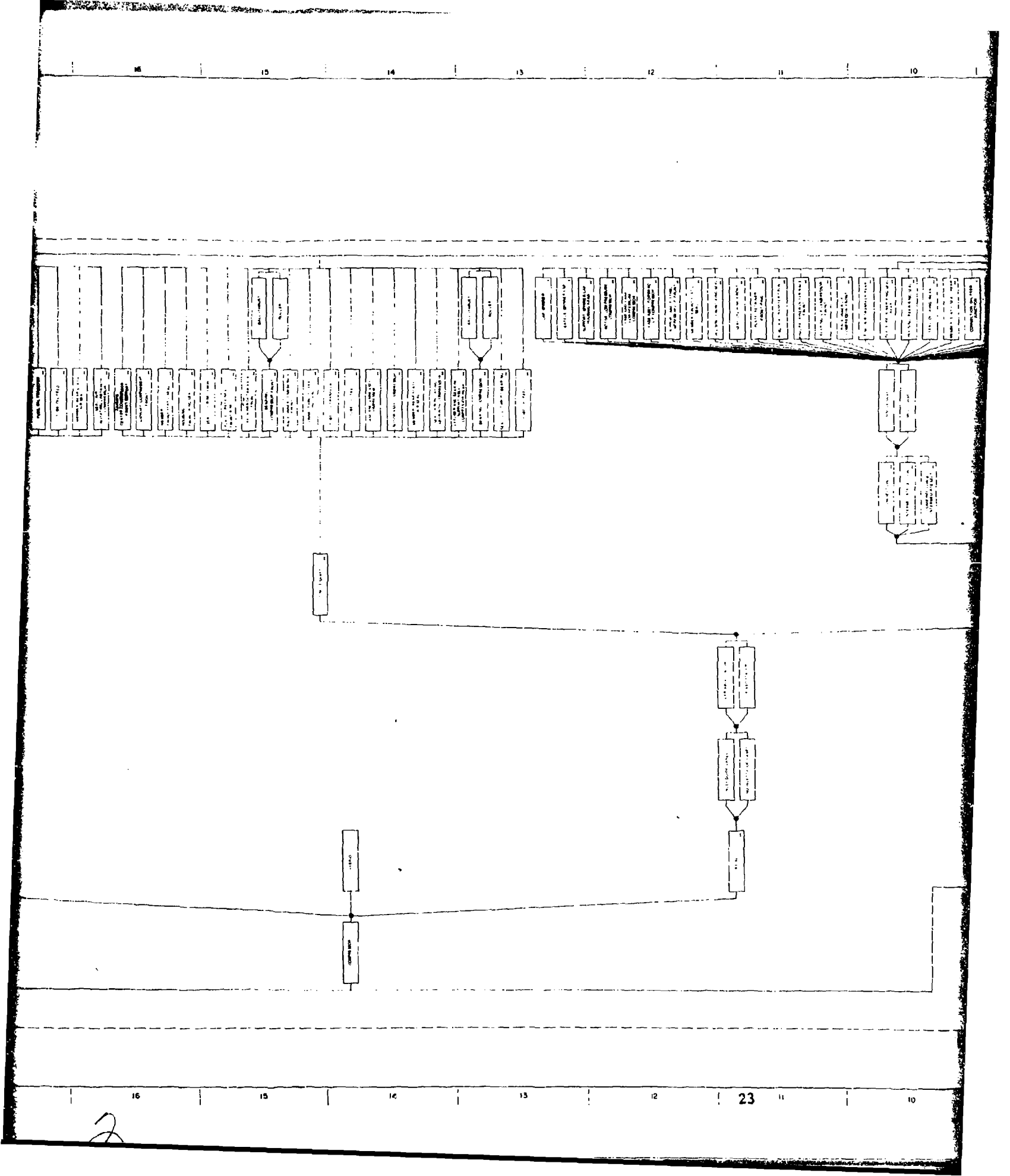
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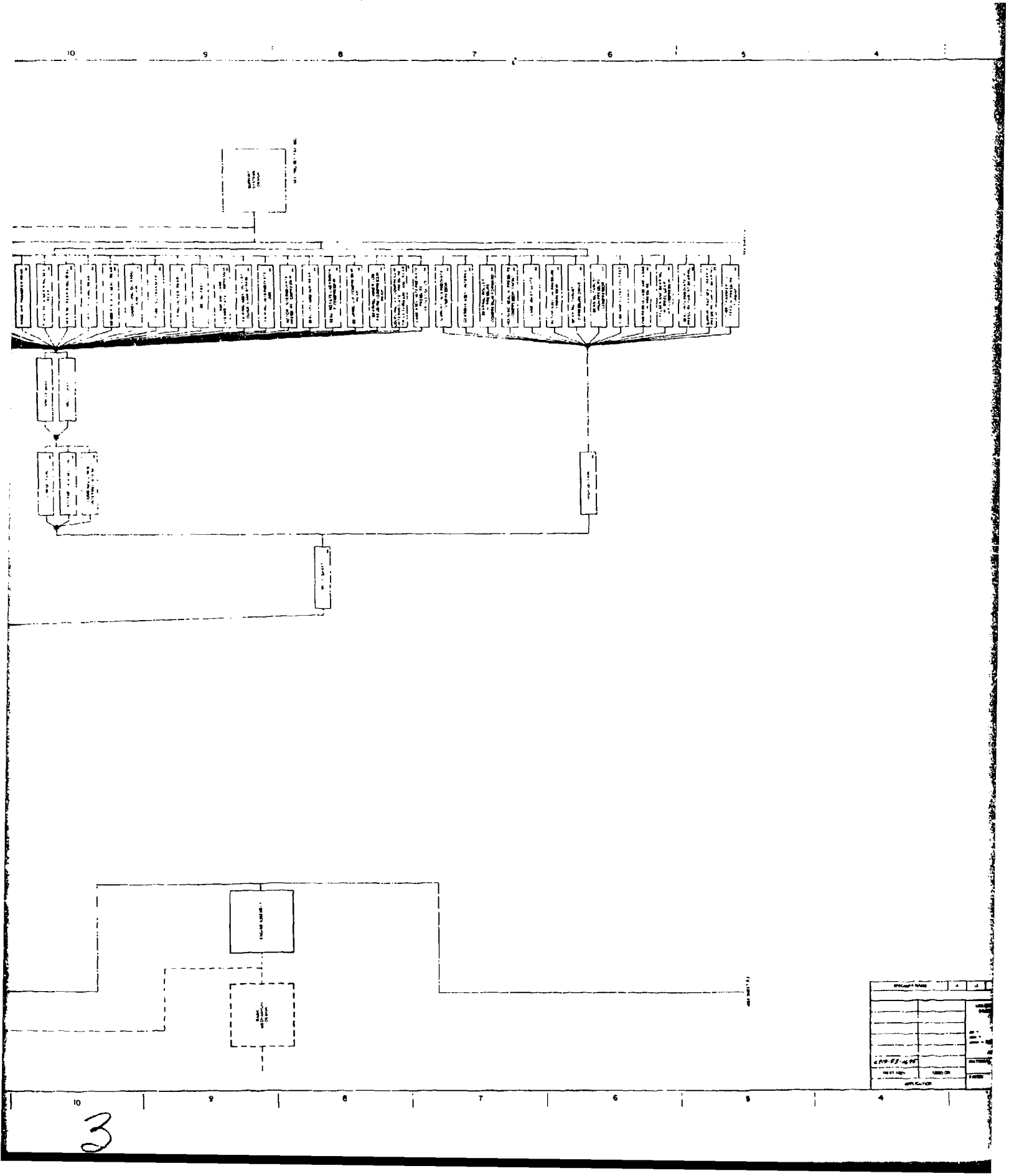

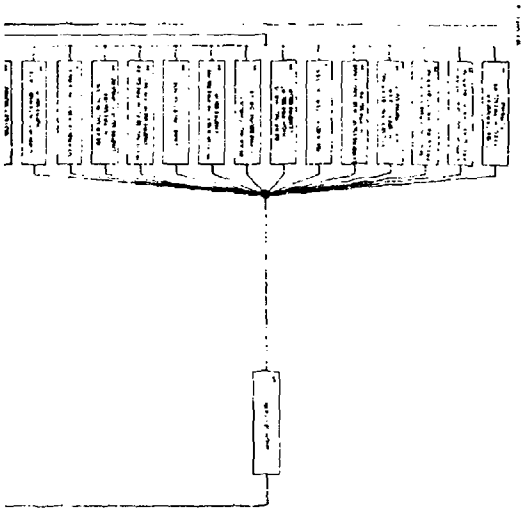

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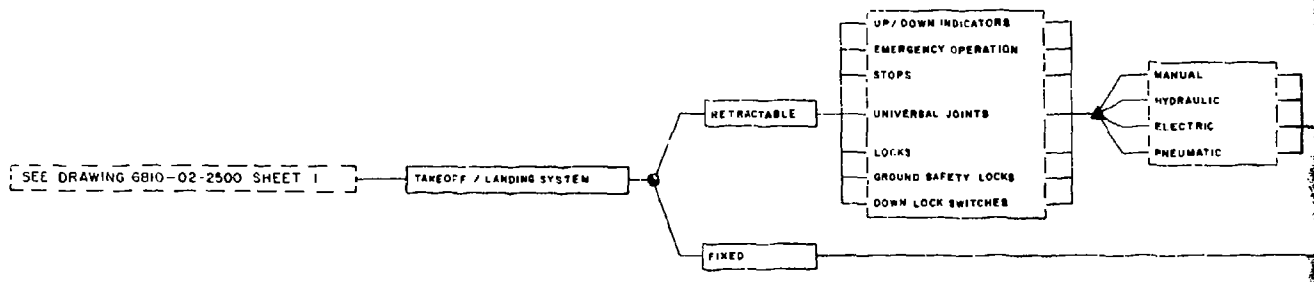
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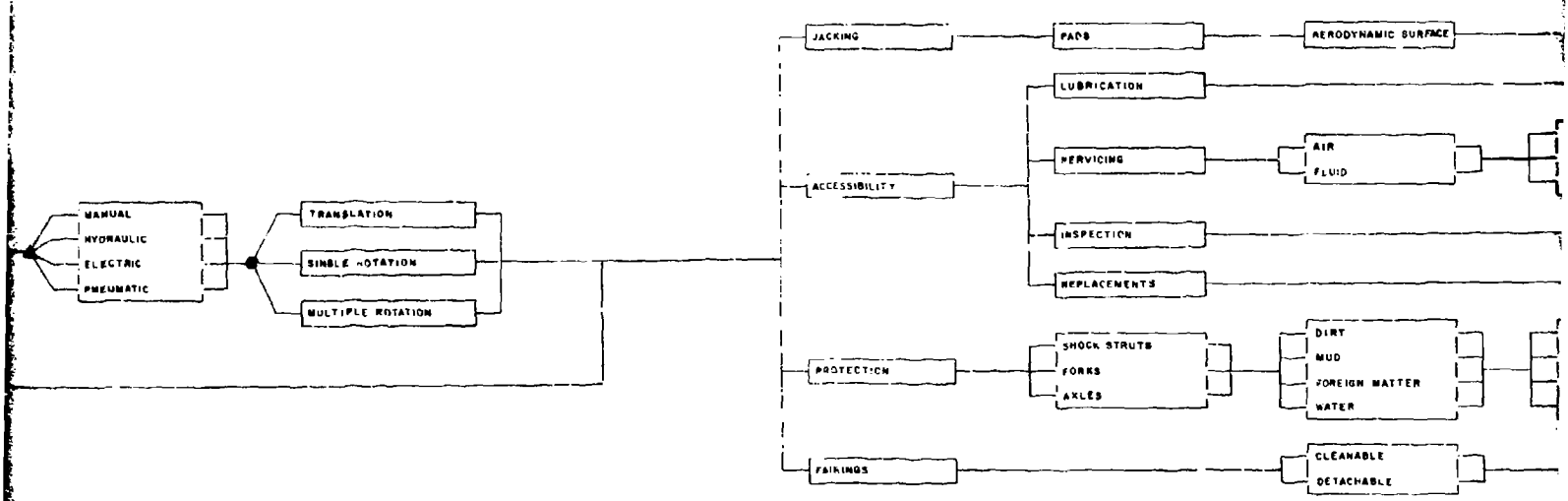
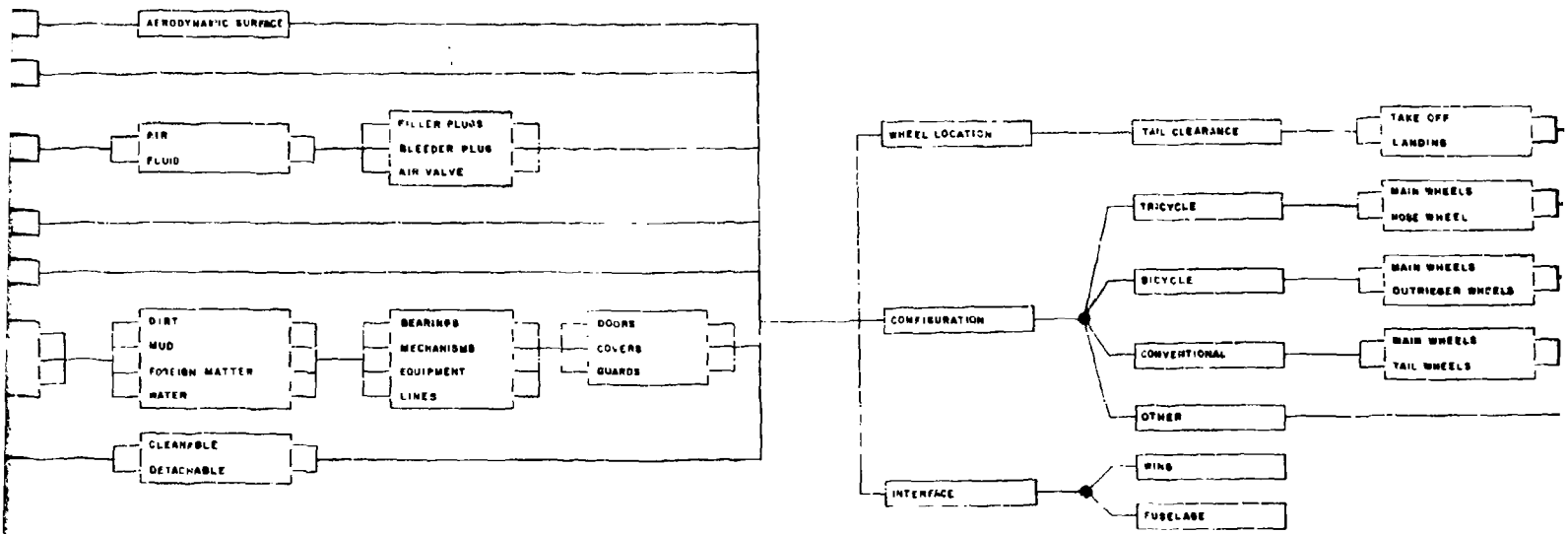
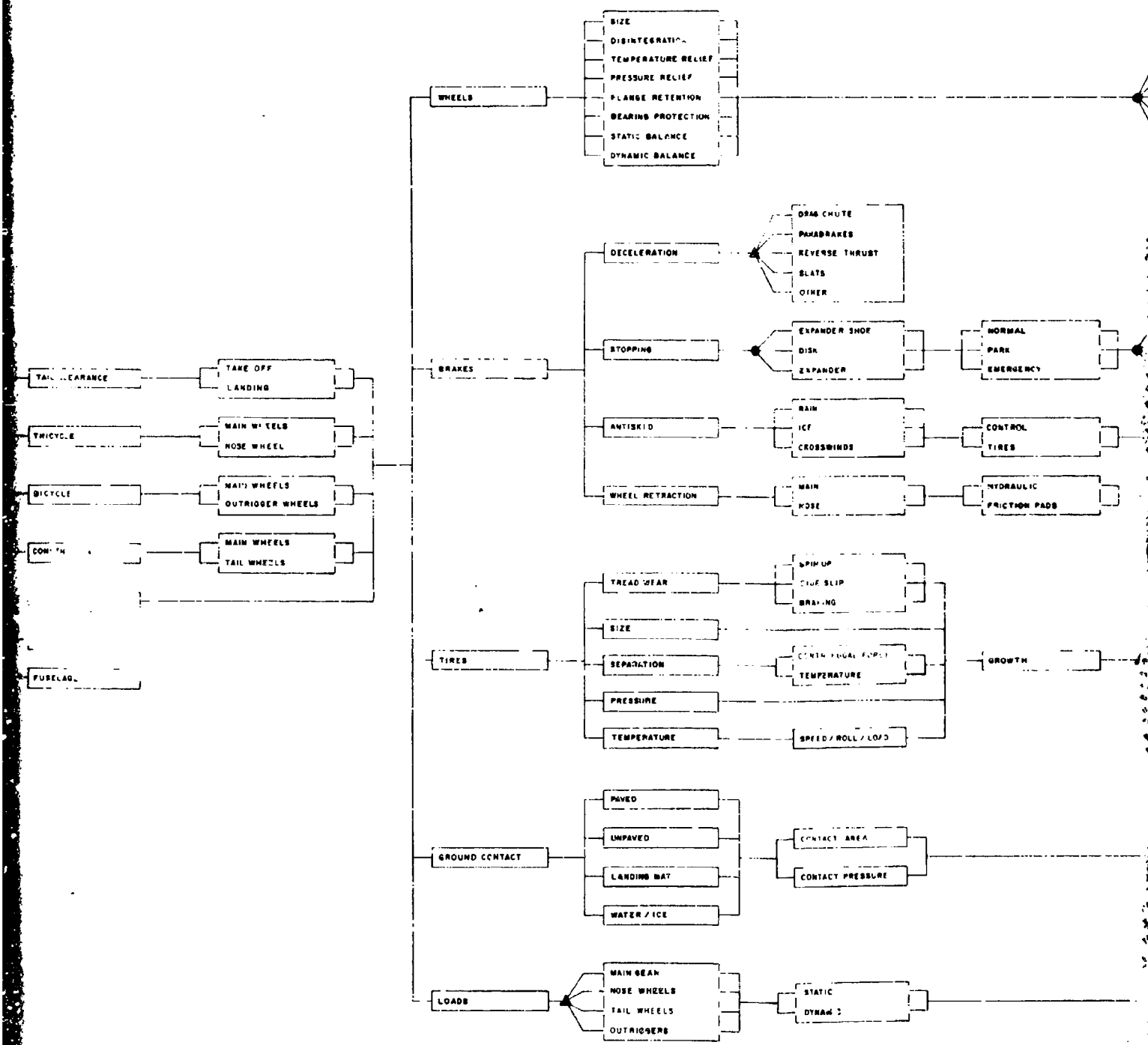
TAKEOFF / LANDING SYSTEM
RETRACTABLE
FIXED
UP/ DOWN INDICATORS
EMERGENCY OPERATION
STOPS
UNIVERSAL JOINTS
LOCKS
GROUND SAFETY LOCKS
DOWN LOCK SWITCHES
MANUAL
HYDRAULIC
ELECTRIC
PNEUMATIC


MANUAL
HYDRAULIC
ELECTRIC
PNEUMATIC
TRANSLATION
SINGLE ROTATION
MULTIPLE ROTATION
JACKING
PADS
AERODYNAMIC SURFACE
LUBRICATION
SERVICING
AIR
FLUID
ACCESSIBILITY
INSPECTION
REPLACEMENTS
PROTECTION
SHOCK STRUTS
FORKS
AXLES
DIRT
MUD
FOREIGN MATTER
WATER
FAIRINGS
CLEANABLE
DETACHABLE


AERODYNAMIC SURFACE
AIR
FLUID
FILLER PLUGS
BLEEDER PLUG
AIR VALVE
DIRT
MUD
FOREIGN MATTER
WATER
BEARINGS
MECHANISMS
EQUIPMENT
LINES
DOORS
COVERS
GUARDS
CLEANABLE
DETACHABLE
CONFIGURATION
WHEEL LOCATION
TAIL CLEARANCE
TAKE OFF
LANDING
TRICYCLE
MAIN WHEELS
NOSE WHEEL
BICYCLE
MAIN WHEELS
OUTRIGGER WHEELS
CONVERTIONAL
MAIN WHEELS
TAIL WHEELS
OTHER
INTERFACE
WING
FUSELAGE

2


WHEELS
SIZE
DISINTEGRATION
TEMPERATURE RELIEF
PRESSURE RELIEF
FLANGE RETENTION
BEARING PROTECTION
STATIC BALANCE
DYNAMIC BALANCE
BRAKES
DECELERATION
DRAG CHUTE
PARABRAKES
REVERSE THRUST
SLATS
OTHER
STOPPING
EXPANDER SHOE
DISK
EXPANDER
NORMAL
PARK
EMERGENCY
ANTISKID
RAIN
ICE
CROSSWINDS
CONTROL
TIRES
WHEEL RETRACTION
MAIN
NOSE
HYDRAULIC
FRICTION PADS
TIRES
TREAD WEAR
SPIN UP
SIDE SLIP
BRAKING
SIZE
SEPARATION
TEMPERATURE
PRESSURE
TEMPERATURE
SPEED / ROLL / LOAD
GROWTH
GROUND CONTACT
PAVED
UNPAVED
LANDING MAT
WATER / ICE
CONTACT AREA
CONTACT PRESSURE
LOADS
MAIN GEAR
NOSE WHEELS
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STATIC
TAKE OFF
LANDING
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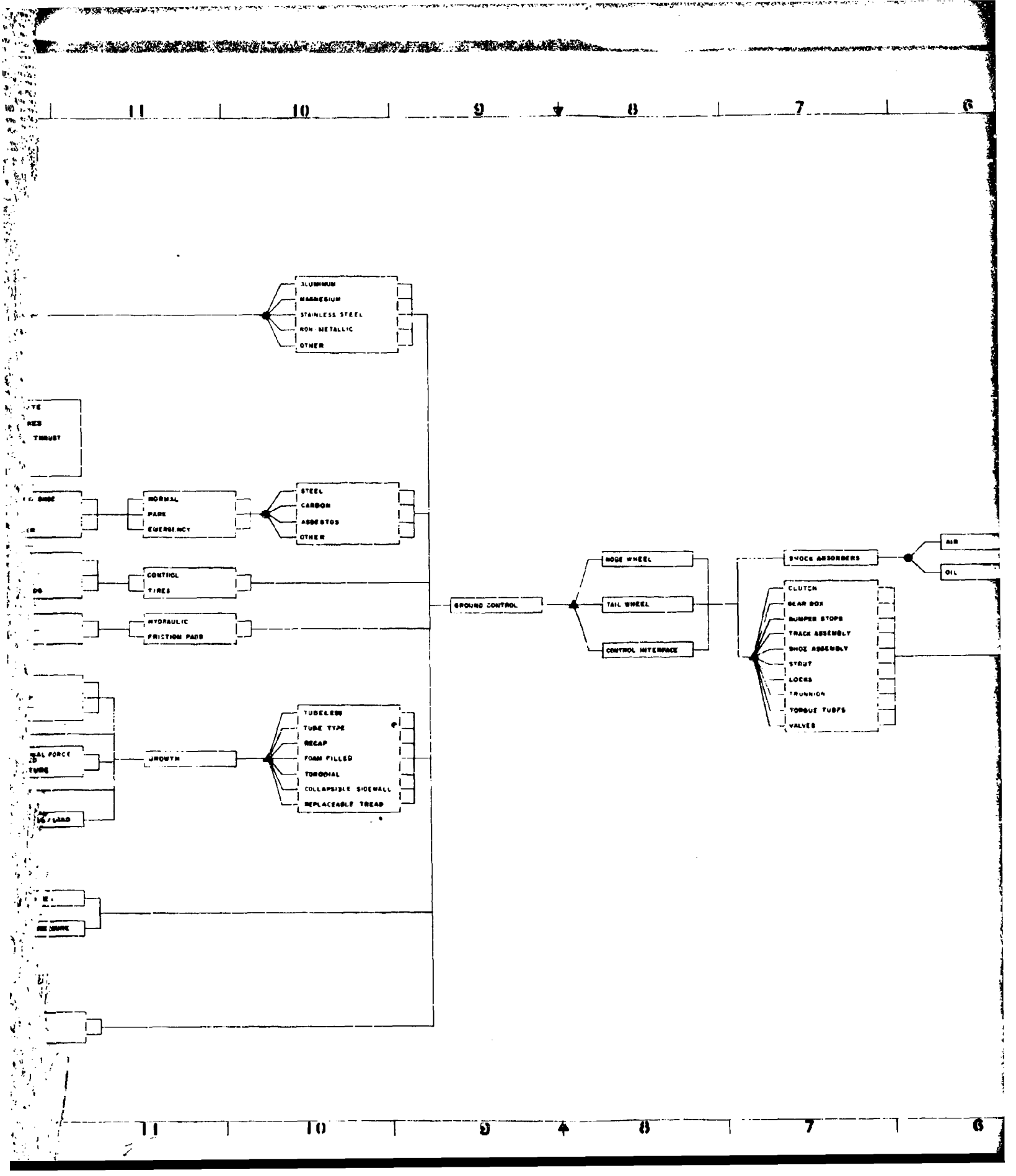
FUSELAGE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ALUMINUM
MAGNESIUM
STAINLESS STEEL
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THRUST
NORMAL
PARK
EMERGENCY
STEEL
CARBON
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CONTROL
TIRES
HYDRAULIC
FRICTION PADS
GROUND CONTROL
NOSE WHEEL
TAIL WHEEL
CONTROL INTERFACE
SHOCK ABSORBERS
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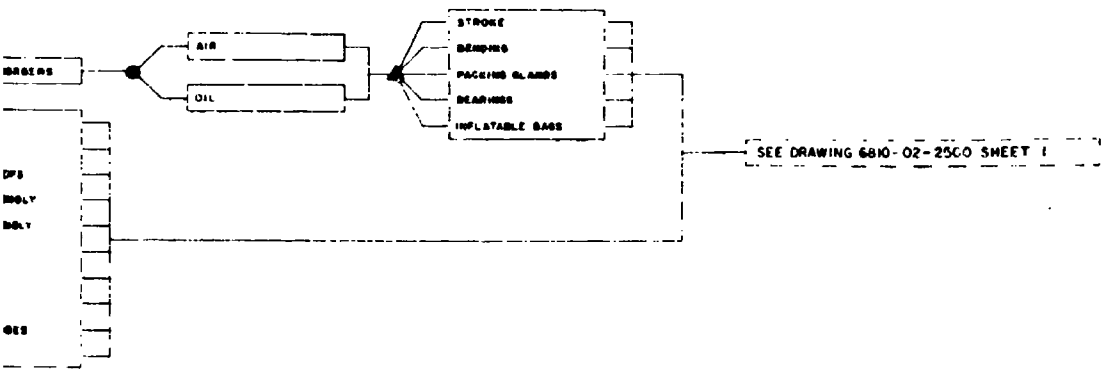
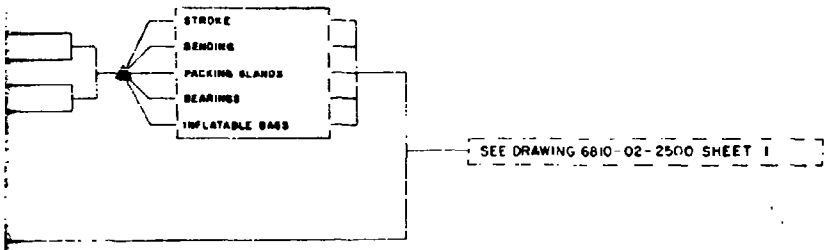
OIL
CLUTCH
GEAR BOX
BUMPER STOPS
TRACK ASSEMBLY
SHOE ASSEMBLY
STRUT
LOCKS
TRUNNION
TORQUE TUBES
VALVES
GROWTH
TUBELESS
TUBE TYPE
RECAP
FOAM FILLED
TOROIDAL
COLLAPSIBLE SIDEWALL
REPLACEABLE TREAD


AIR
OIL
STROKE
SEALING
PACKING GLANDS
BEARINGS
INFLATABLE BAGS
SEE DRAWING 6810-02-2500 SHEET 1



DECISION TREE –
RPV AIRFRAME

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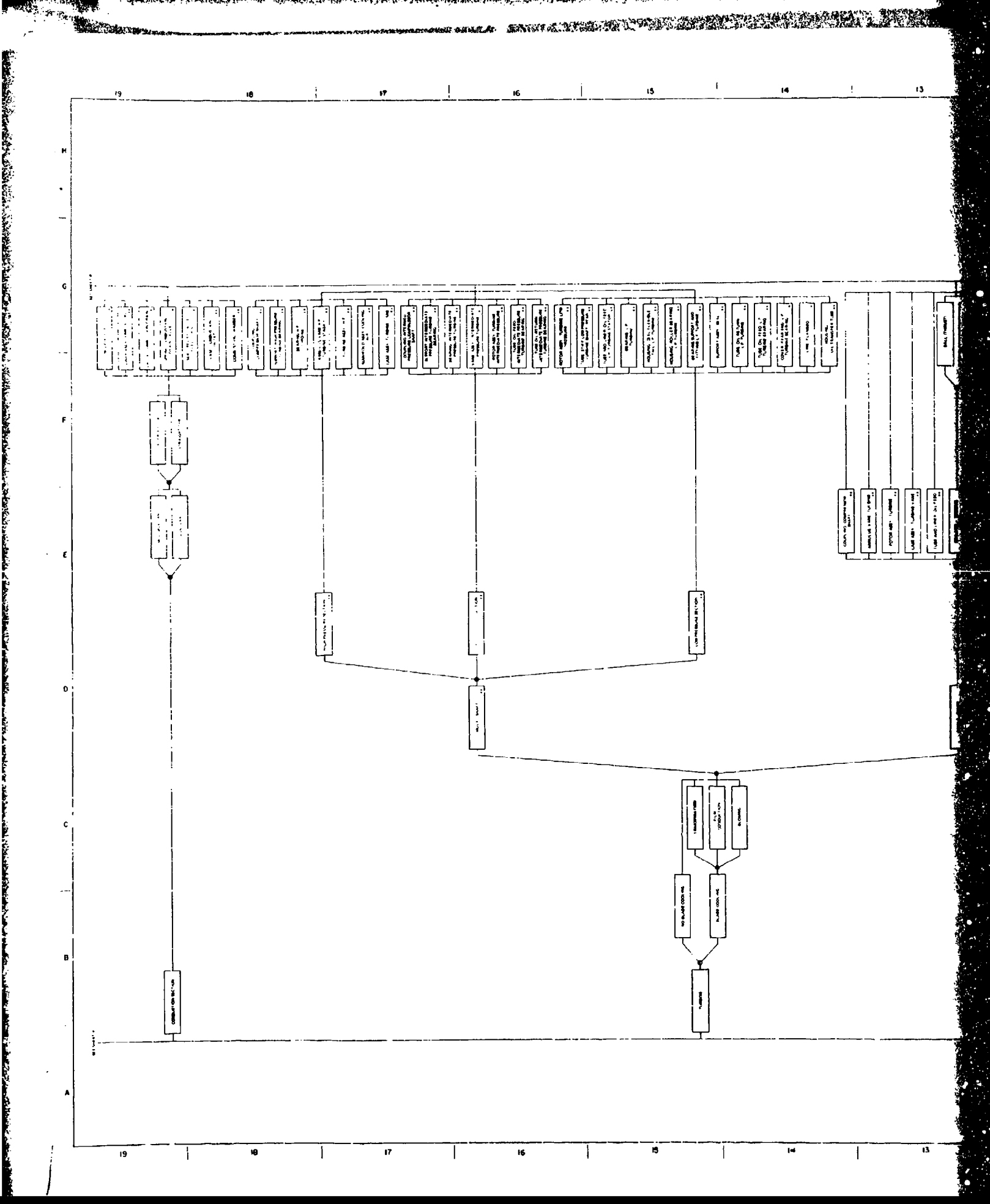

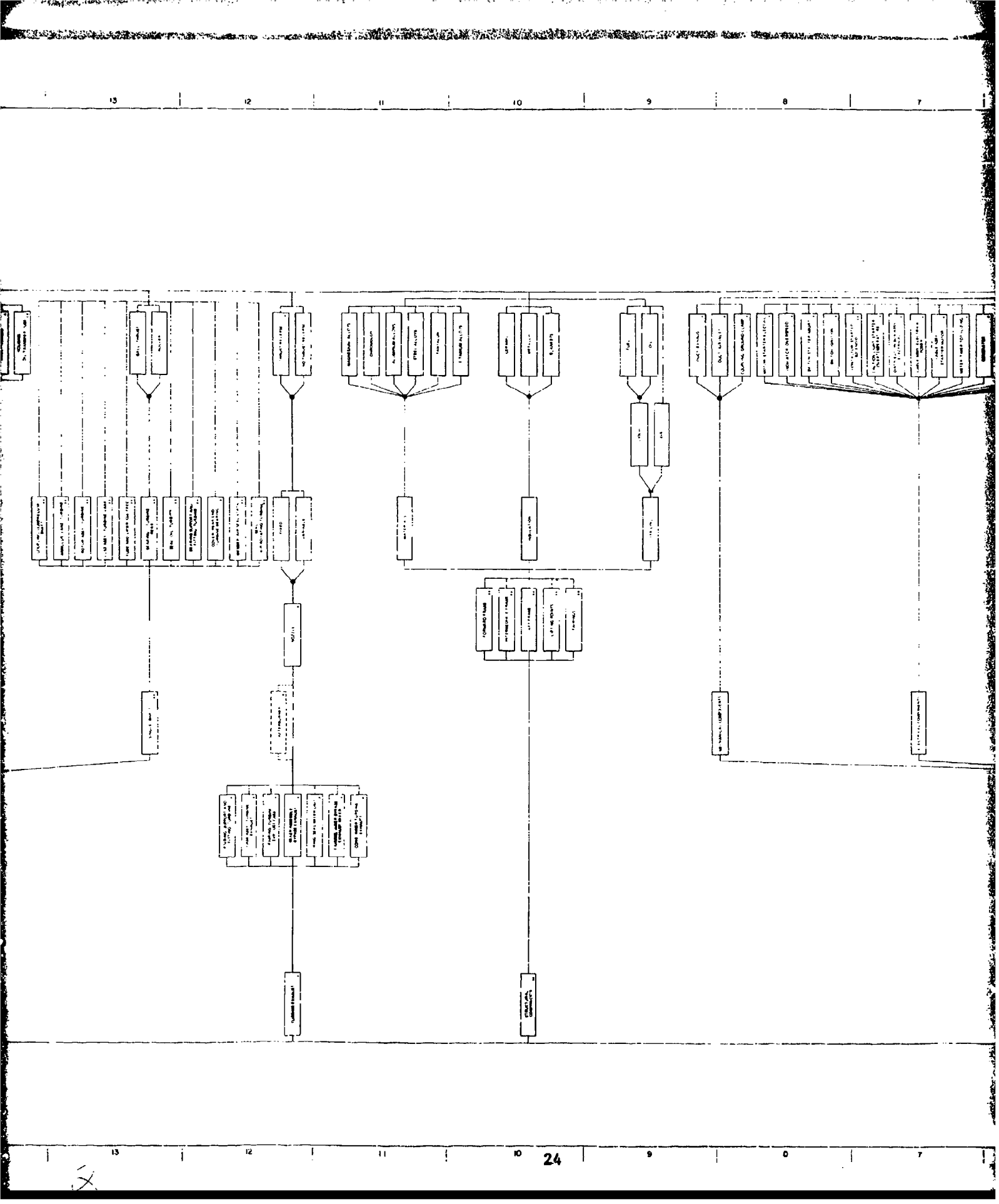

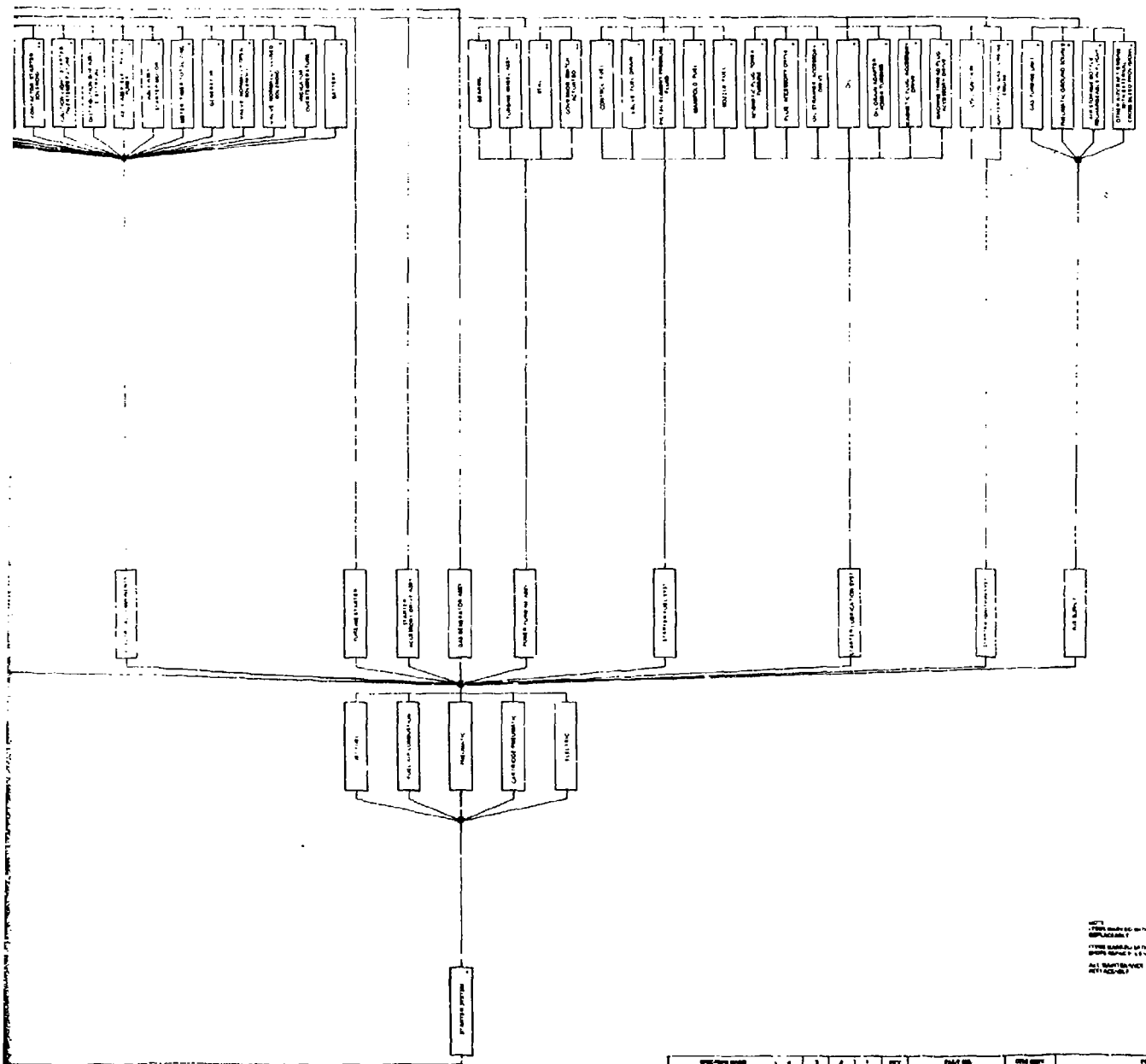

DECISION TREE, JET ENGINE
ENGINE ASSEMBLY

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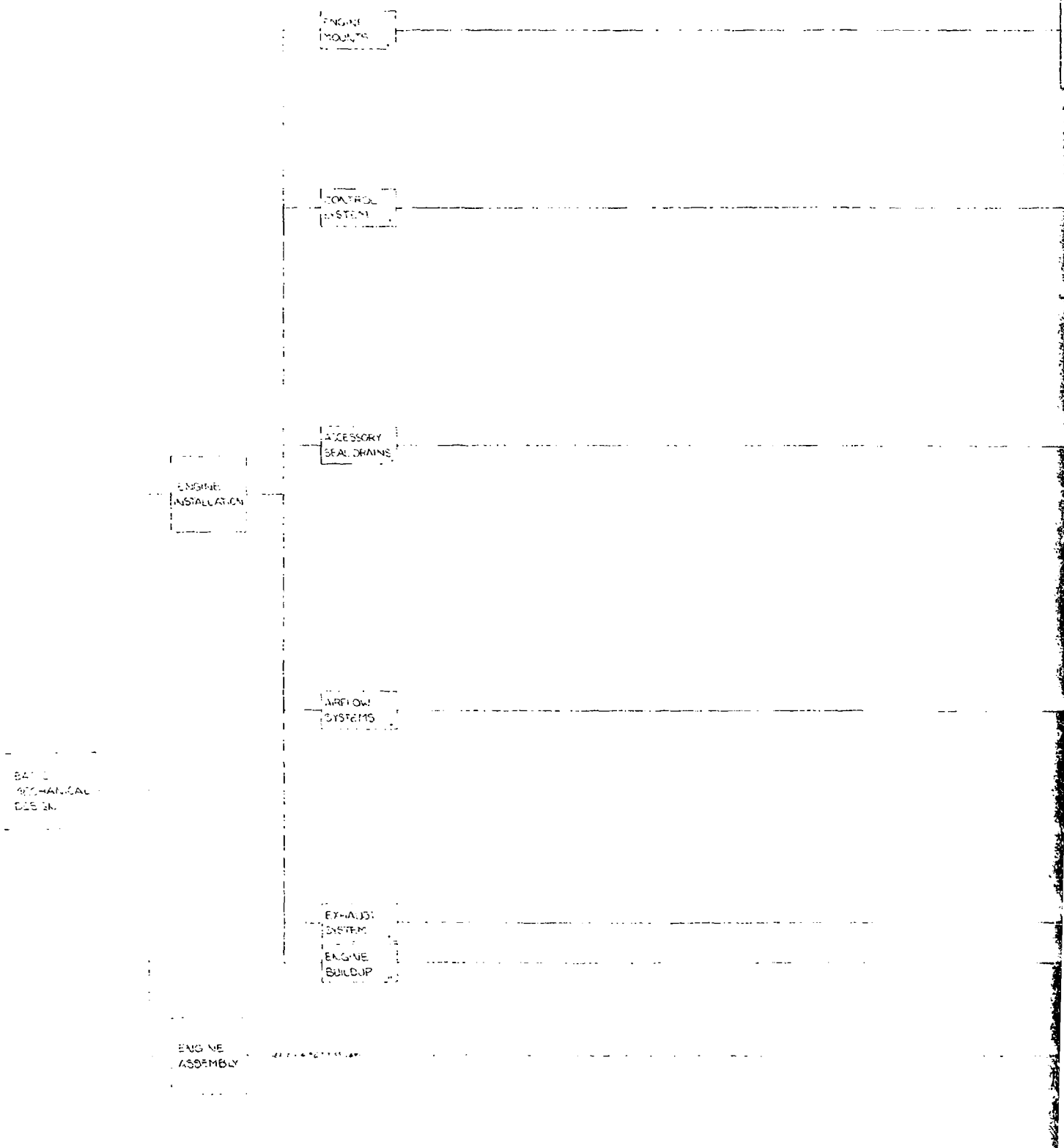
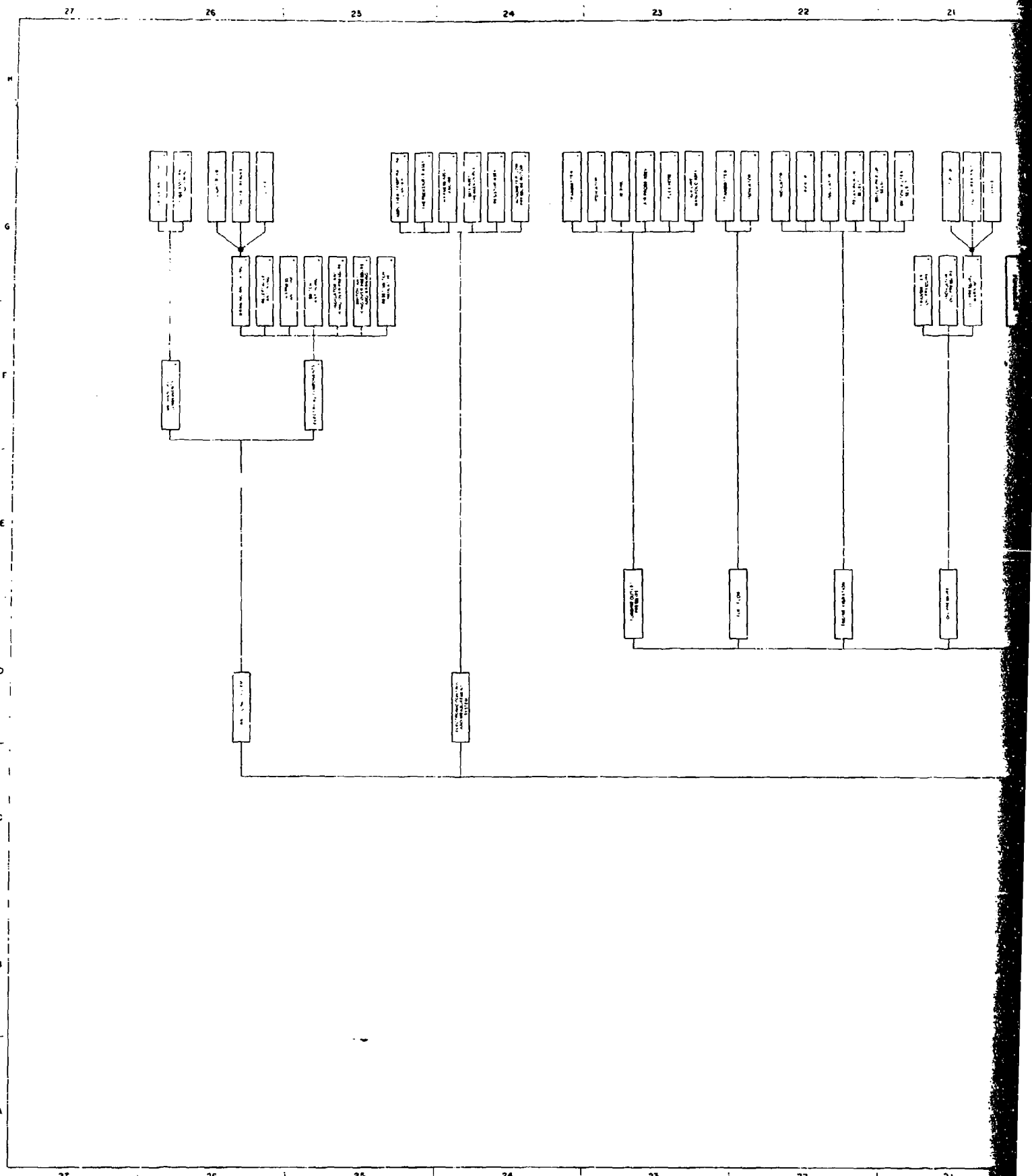

ENGINE MOUNTS
CONTROL SYSTEM
ACCESSORY SEAL DRAINS
ENGINE INSTALLATION
AIRFLOW SYSTEMS
EXHAUST SYSTEM
ENGINE BUILDUP
ENGINE ASSEMBLY

SUPPORT SYSTEMS DESIGN
SEE DWG #6715-53-1092
DECISION TREE, JET ENGINE
ENGINE INSTALLATION
J 14590 6715-53-1096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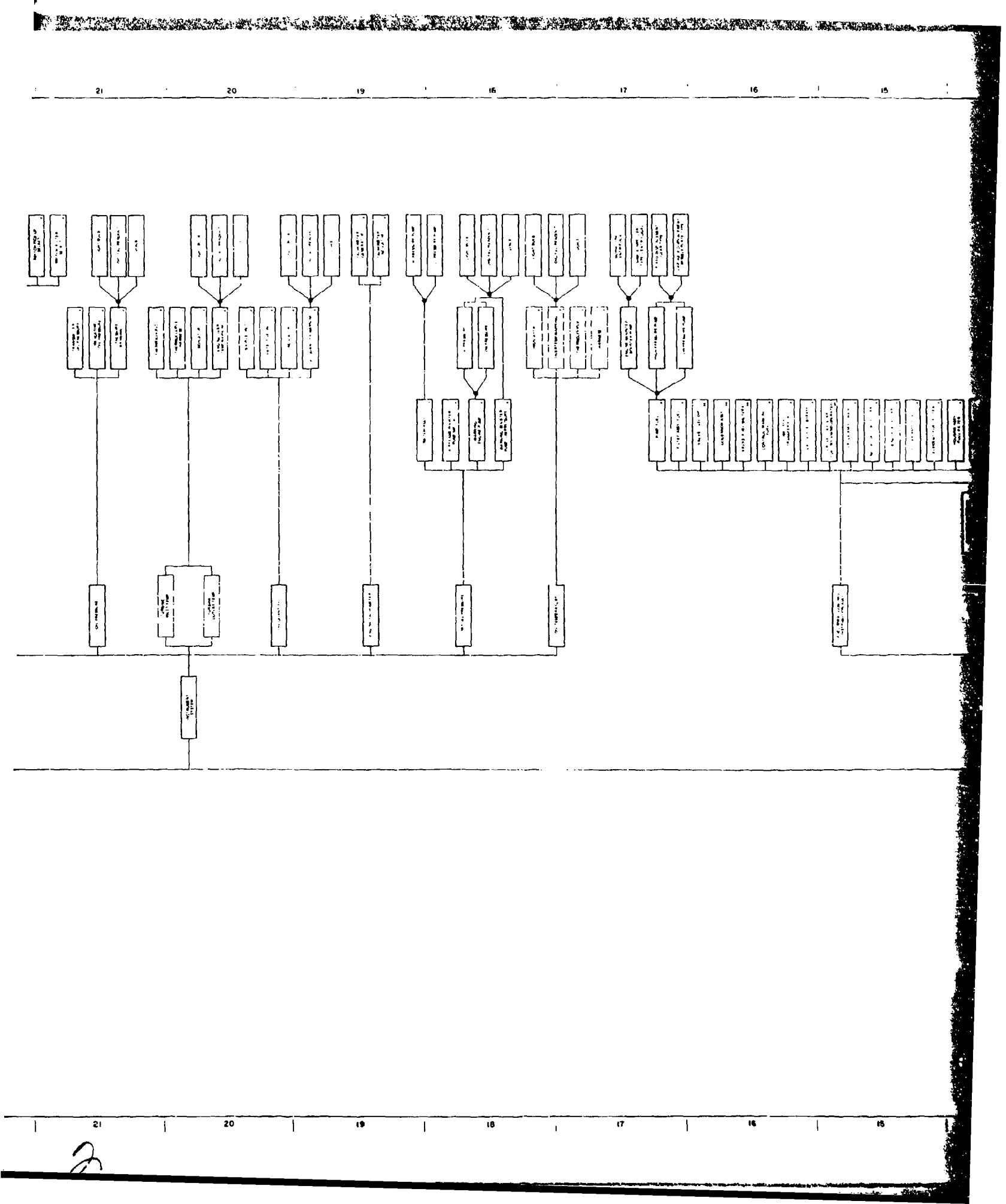
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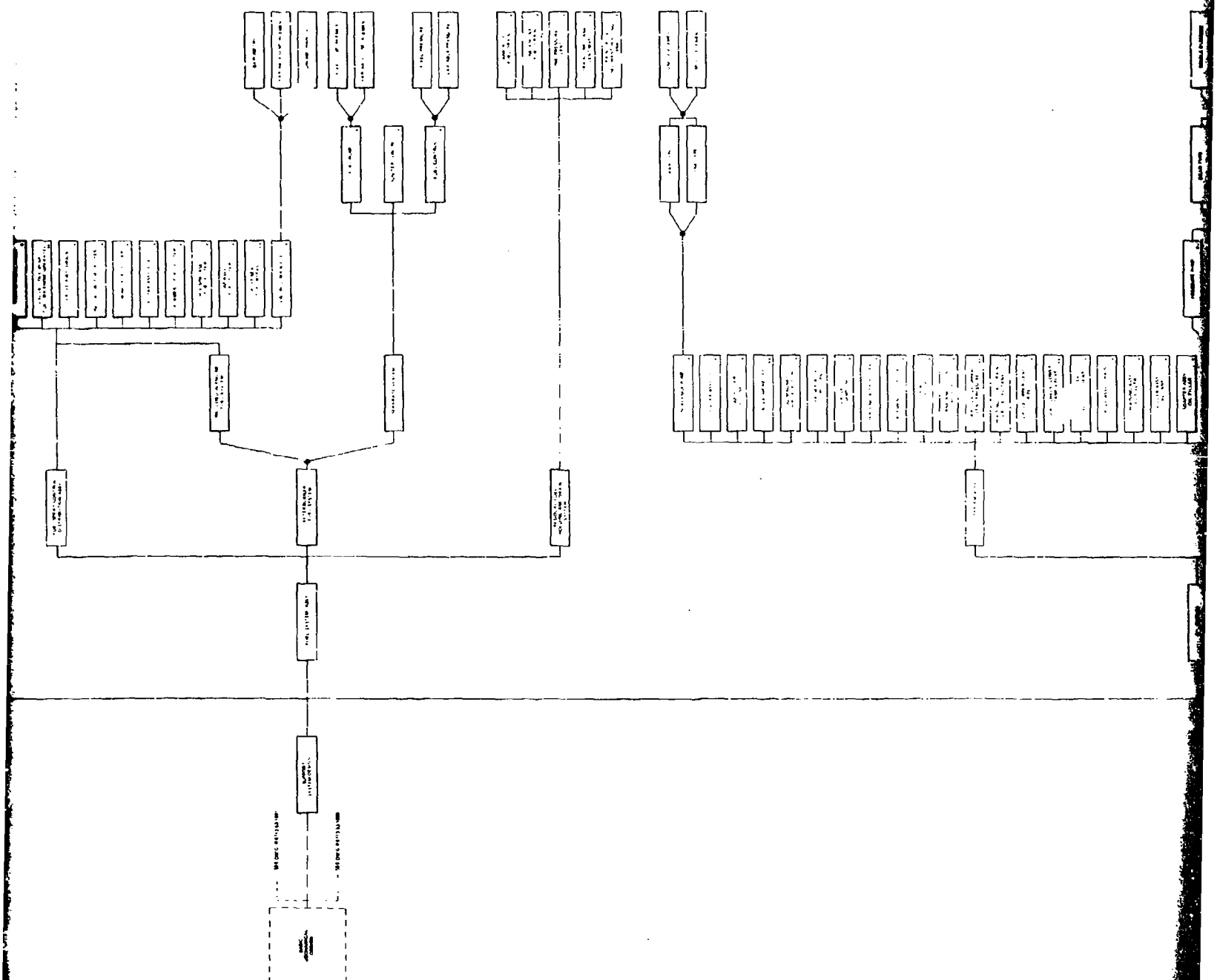

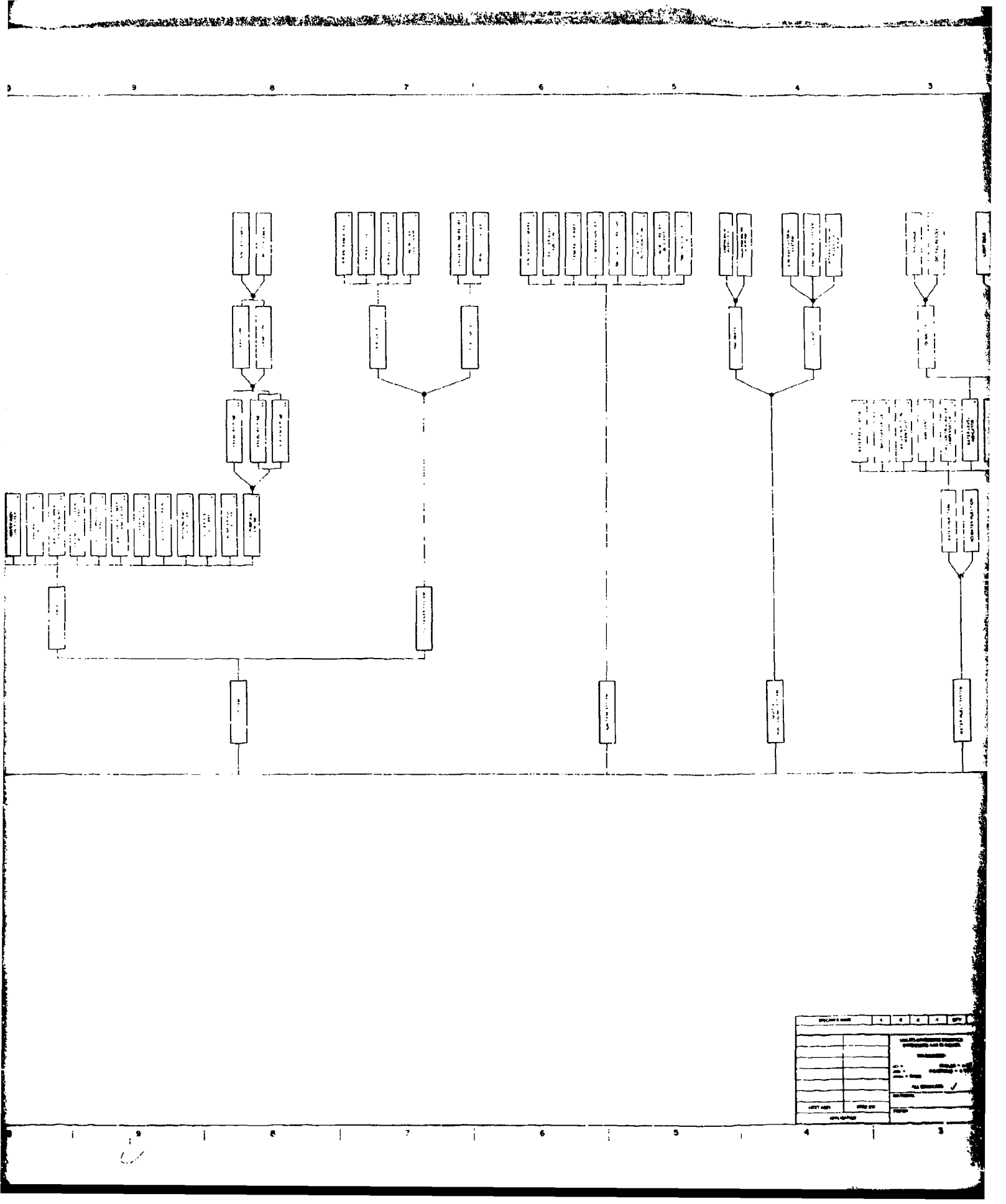

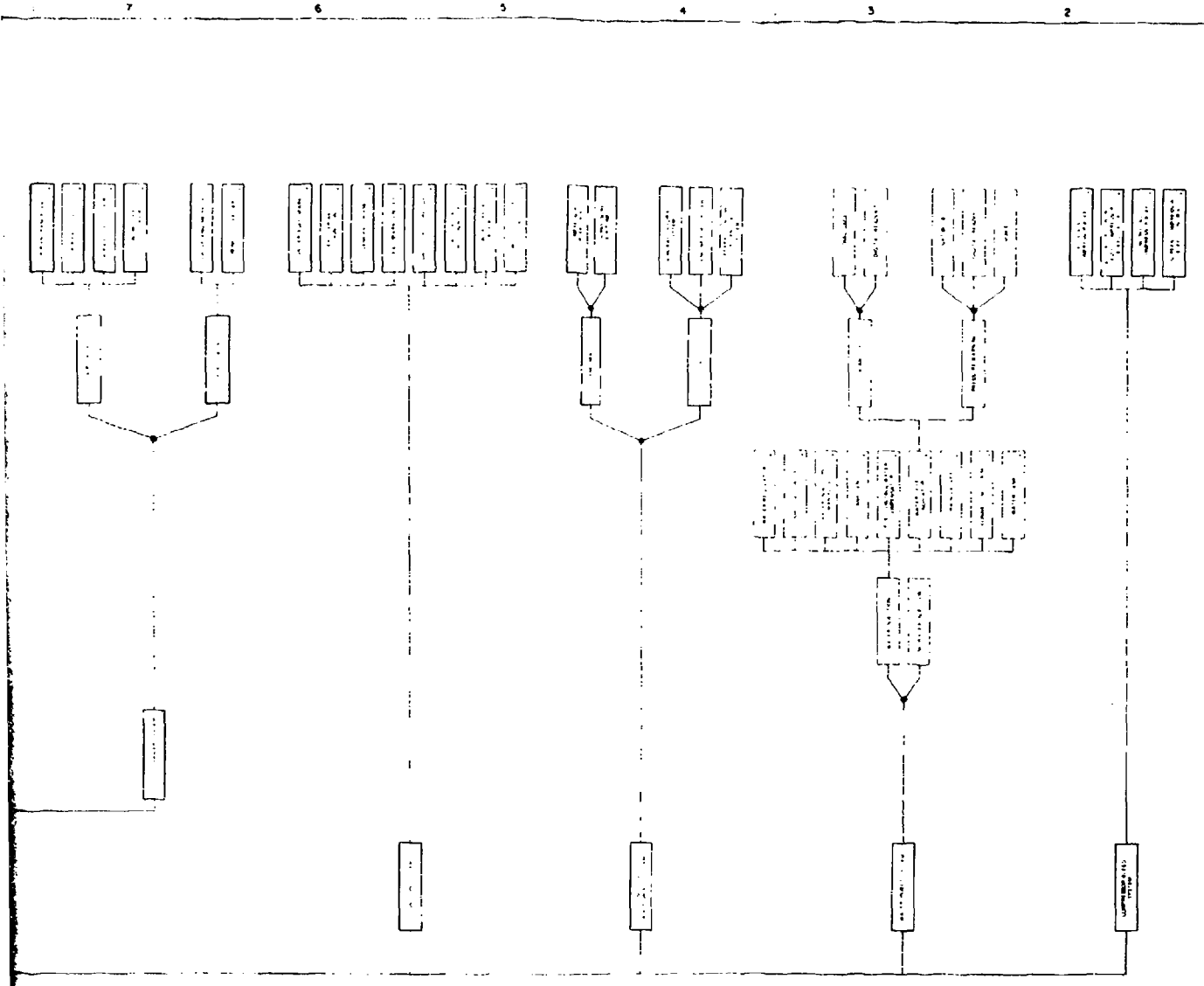

DECISION TREE, JET ENGINE - SUPPORT SYSTEM DESIGN

14590

6713-53-1692

Section IV

DEFINITIONS

REMOTELY PILOTED VEHICLE DODT

The following is a list of definitions of the terms used in the Remotely Piloted Vehicle DODT.

NOTE: The numbers and letters in parenthesis are drawing coordinates used to denote locations when a word is used more than one time with more than one meaning.

Aerodynamics -- Those forces generated by the movement of air over the surfaces of the vehicle and the resulting motion of the vehicle.

Aeroelasticity -- The deflections and vibrations of the airframe caused by the air loads due to the non-rigid nature of the airframe.

Air Defense -- Operations keyed to prevention of air attack by some adversary.

Air Loads -- The aerodynamic loads imposed upon the airframe structure.

Airbreathing -- Engines which require an inlet utilizing atmospheric air for combustion.

Aircraft -- A vehicle whose primary sustaining force is the dynamic reaction of air against its surfaces.

Airframe -- The structural components which make up the vehicle configuration and support the included vehicle subsystems.

Airframe/Propulsion Interface -- Those items involved in installation and operation of the propulsion system which require integration with airframe structure and aerodynamic configuration.

Altitude -- Height above theoretical sea level based on local air density.

Armament -- Projectiles, powered or unpowered, intended to destroy a target.

Avionics -- Electrical/electronic equipment tailored to a given RPV mission.

Avionics Interface -- The network by which the avionics system actuates the flight controls to provide desired navigation, maneuvers, etc.

Bomber -- A vehicle which carries air-to-ground weapons to a distant target.

Bomber Defense -- A mission involving accompanying a bomber for the purpose of protection.

Close Air Support -- A tactical mission assisting the immediate objectives of ground based forces.

Communications Relay -- A vehicle which serves as a communications link between stations which would otherwise be out of range.

Control Station -- The console from which the RPV is guided and operated while flying.

Conventional -- Using a standard aircraft runway.

Core Avionics and Information Processing -- Avionics equipment, information exchange and processing equipment, and required interfaces which are part of the basic operation of the RPV, exclusive of specific mission payload equipment.

Decoy -- A vehicle which draws attackers away from the bomber.

Defensive -- A mission whose basic purpose involves preventing an attack by some other source.

Direct Thrust Production -- Direct conversion of temperature and pressure into thrust; e.g., a rocket engine.

EW/ECM -- Electronic noise, jamming, illumination, etc., intended to modify the effectiveness of avionics equipment.

Electric -- Engines which run on electrical energy, either generated by the vehicle subsystem or stored in batteries.

Enclosed/Internal Fan -- Fan or compressor enclosed in a shroud or within an engine casing; e.g., a fanjet or ducted propeller.

Expendable -- A vehicle which is not recovered for reuse.

Fighter/Bomber -- A tactical vehicle capable of a mixture of bombing and missile/rocket/gun attacks.

Fixed Wing -- A wing whose position and sweep are not variable.

Flight Controls -- Those aerodynamic surfaces that maneuver the vehicle along with their associated mechanisms and actuators.

Flight Equipment -- Equipment which is part of the flyable RPV.

Forward Air Controller -- A tactical aircraft crew member who directs the delivery of munitions on specified targets.

Free Fan/Propeller -- An unrestrained fan or propeller; e.g., a standard propeller driven by reciprocating or turbine engine.

Ground Equipment -- Any support equipment which is not part of the flyable RPV.

Hybrid -- A combination of wing types. (13/D)

Hybrid -- A vehicle whose configuration is not clearly definable as aircraft or missile. (16/E)

Hybrid -- New technology combinations of airbreathing and non-airbreathing, such as turbo-rocket and ramjet/rocket. (8/G)

Hypersonic -- High supersonic speed, usually taken as above Mach 5.0.

Interceptor -- A strategic interceptor is one which has the capability to intercept attacking forces while they are still safely distant from their target. (20/G)

Interceptor -- A tactical interceptor has the mission of maintaining control of airspace over a field of action to allow other operations to continue in reasonable safety. (20/F)

Interceptor -- A vehicle which destroys those vehicles attacking a bomber. (19/A)

Interdiction -- A tactical mission whose objective is cutting enemy supply lines.

Jet -- Denotes ramjet and all classes of turbine engines.

Launch -- That segment of the RPV mission which involves getting the vehicle off the ground and into a flight condition from which the mission can be initiated.

Lifting Body -- A vehicle without wings but whose shape generates aerodynamic lift.

Logistics Support -- Management and maintenance of parts supplies, personnel training, repair facilities, etc., outside of operational organization.

Maximum In-Flight G-Loads -- Maneuver loads imposed during performance of the mission excluding launch and recovery.

Missile -- A vehicle whose primary sustaining force is its propulsion system.

Multiple -- An indication of the possibility that an RPV may be designed to fulfill more than one of the previous classes of missions.

NAV/COM -- That equipment involved in determining and controlling the position and velocity of the vehicle and in transmitting information to and from the vehicle.

Navigation -- That equipment involved in determining the position and velocity of the vehicle. (9/D)

Navigation Source -- A vehicle which provides a beacon of known position from which other positions can be determined.

Non-airbreathing -- Those propulsion systems which do not require an intake for combustion air.

Nuclear -- Engines using a nuclear reactor as an energy source.

Offensive -- A mission whose basic purpose involves an attack initiative.

Operation and Maintenance -- Personnel, facilities, and equipment required to maintain the RPV system in an operational status and to conduct operations.

Other -- General utility missions not previously included. (20/C)

Penetration -- A bomber intended to make its way through an adversary's defense system without being detected.

Performance -- The characteristic speed, altitude, maneuverability, and other parameters which describe the ability of the vehicle to perform a given flight profile.

Primary Mission Equipment (Payload) -- On-board equipment whose specific function is to carry out the particular RPV mission.

Propulsion -- The thrust producing system which propels the vehicle.

Range -- Distance vehicle can cover and still accomplish its mission.

Reciprocating -- Internal combustion engines using reciprocating motion of pistons for power transfer.

Reconnaissance -- A mission whose primary purpose is collecting information. (20/H)

Reconnaissance -- A tactical reconnaissance involves gathering of information on specific objectives required to allow effective use of other tactical operations. (20/F)

Recoverable -- A vehicle which is recovered for refurbishment and/or replenishment and reuse.

Recoverable Payload -- Some part of a vehicle which is recovered while other parts are not recovered.

Recovery -- The terminal segment of the mission which involves those steps necessary to return all or part of the vehicle to a base for reuse.

Remotely Piloted Vehicle -- An aerospace vehicle which is flown by an operator in real time physically isolated from the vehicle.

Rocket -- Engines carrying self-contained fuel and oxidizer to produce thrust from a nozzle.

Rotary Wing -- A wing whose position can or must rotate, e.g., a helicopter rotor.

Stability and Control -- The ability of a vehicle in flight to maintain an equilibrium condition and the ability of the controller to change the equilibrium condition.

Stand-off -- A bomber which can attack a ground target while staying reasonably distant from the target.

STOL -- Using a short runway, i.e., typically 1500 feet or less.

Strategic -- Operations covering a wide geographical scale or having widespread and long term effects.

Subsonic -- Speed below Mach 1.0.

Supersonic -- Speed above Mach 1.0.

Supply -- Delivery of equipment and various materials to sites for use and/or further distribution.

Surveillance -- That equipment used for monitoring activities and information; typically photographic, television, radar, infrared, acoustic, and radio.

System Objectives -- Goals the RPV system is intended to fulfill. May be mission requirements, design-to-cost, minimization of operation and maintenance costs, incorporation of a specific subsystem, or any other similar guiding considerations.

Tactical -- Operations intended to accomplish specific missions of more limited scope.

Thrust Augmentation -- Entrainment of air by turbulent shear forces on the boundaries of the primary thrust producer resulting in increased total thrust; e.g., an ejector system.

Tilt Wing -- A wing with variable incidence.

Training -- Familiarization of operators with the proper utilization of available equipment.

Transonic -- Transition speed range, usually taken as between Mach 0.8 and Mach 1.3.

Type of Propulsion -- The general class of thrust producing device to be employed.

Utility -- A grouping of those missions which do not clearly fit under the previous mission groupings.

Variable Sweep Wing -- A wing whose sweep angle can be varried in flight.

VTOL -- Requiring no ground roll for takeoff or landing.

Weapon Delivery -- Equipment involved in the selection, activation, and delivery of a weapon on the desired target.

LAUNCH SYSTEMS DODT
(Dwg. No. 6810-02-2497)

The following is a list of definitions of the terms used in the Launch Systems DODT.

Aft of Nose -- Refers to inlet aft of forward extremity of fuselage.

Air -- Launch methods which entail releasing the vehicle from a flying launch platform.

Air Cushion System -- An inflated skirt or bag which serves as ground effect flotation to replace standard type landing gear.

Airfoil -- The cross-section of the wing or tail surface in a plane cut parallel to the fuselage centerline.

Airframe Configuration -- The distribution of shape and size of airframe components.

Allowable Weight -- Weight of equipment which can be installed in each available space.

Ancillary Equipment -- AGE, test and checkout equipment, and maintenance equipment.

Angle of Attack -- The angular orientation of the wing with respect to the on-coming air required to maintain a specified flight condition.

Area -- The area of the wing or tail surface planform shape.

Available Launch/Recovery Space -- Space within the vehicle which can be occupied by Launch equipment.

Bottom -- Exhaust at bottom centerline of fuselage.

Center -- Exhaust centered or nearly centered on fuselage centerline.

Component Location -- Spares occupied by components and/or systems other than launch.

Cross Section -- The size and shape of the fuselage envelope at various lengthwise locations.

Dolly -- A wheeled cart on which the RPV executes a runway take-off, but separates from the vehicle and remains on the ground.

Engine Exhaust Position -- Location of exhaust for combustion products and cooling air for the propulsion system.

Engine Inlet Position -- Location of inlets for combustion air and cooling air for the propulsion system.

External -- Stores attached in such a manner as to remain outside the contours of the airframe, e.g., pylons or racks.

External Parasite -- Refers to an RPV which is carried outside the contours of the launch vehicle prior to launch such as mounted on a wing pylon.

Forward of Rear -- Exhaust plane forward of aft extremity of fuselage.

Fuselage -- The central pod or enclosure to which wings and tail surfaces are attached.

Fuselage -- Stores attached to or within the fuselage.

Fuselage Bottom -- Inlet location on bottom centerline of fuselage.

Fuselage Side -- Inlets on sides of fuselage including inlets at wing-fuselage junction.

Fuselage Top -- Inlet location on top centerline of fuselage.

Gross Weight -- The total weight of the vehicle including all fuel and removable loads.

Ground -- Launch methods which entail starting the launch sequence with the RPV on the ground.

Internal -- Stores contained within the contours of the airframe.

Internal Parasite -- Refers to an RPV which is carried inside the launch vehicle prior to launch.

Lateral G-Load -- The aerodynamic and inertial forces on the airframe in a side-to-side orientation normalized by vehicle weight.

Launch -- That segment of the RPV mission which involves getting the vehicle into a flight condition from which the mission can be initiated.

Length -- Nose to tail dimension of the fuselage.

Logistics Requirements -- Personnel, equipment, and facilities needed to keep a system in operational status.

Longitudinal G-Load -- The aerodynamic and inertial forces on the airframe in a front-to-back orientation.

Maintenance -- Personnel, equipment, etc., required to keep the RPV system in an operational readiness status.

Minimum Safe Airspeed -- The minimum airspeed at which the vehicle will remain airborne with an appropriate safety factor above the stall speed.

Nose -- Refers to inlet at forward extremity of fuselage.

Number of Personnel -- Size of required O&M group.

Operation -- Personnel, equipment, etc., directly involved in checkout and performance of the RPV mission.

Personnel Skills -- The types of skills and levels of competence required to perform Operations and Maintenance (O&M) tasks.

Planform -- The shape of the wing or horizontal tail surface as projected vertically from above or below. Also the shape of the vertical tail surface as projected perpendicular to the side.

Position -- The location of both horizontal and vertical tail surfaces on the fuselage or wings.

Rear -- Exhaust located at aft extremity of fuselage.

Replacement of Consumables -- Replacement of any items or equipment not intended for re-use.

Retractable Gear -- Standard wheel type landing gear which retracts into the vehicle after takeoff.

Safety -- Special tests, equipment, and personnel required to insure safety of O&M group and nearby uninvolved personnel.

Short Length -- Launch system which has a requirement for a ground run but not a length typical of a runway, e.g., a catapult.

Side -- Exhaust on side of fuselage.

Special Facilities -- Those facilities unique to an RPV system which would not be presently available at the proposed RPV base of operation.

Stores Location -- Location of any/all equipment, munitions, and fuel pertinent to the mission without destroying the basic aerodynamic and/or structural integrity of the vehicle.

Structural Requirements -- The strength of the airframe structure required by a potential launch system and the associated dynamic environment.

Tail Surfaces -- The airfoil surfaces which provide lateral and longitudinal stability and control.

Top -- Exhaust at top centerline of fuselage, including location at base of vertical fin.

Tow-Off -- Launch system which involves using another vehicle to tow the RPV off from a runway.

Training -- Development of skills required of operation and maintenance personnel.

Vertical G-Load -- The aerodynamic and inertial forces on the airframe in a top-to-bottom orientation.

Volume -- Volume available for stores at each available location.

Volume -- Volume of each compartment available for launch equipment.

Weight -- Allowable weight which can be installed at each location.

Wing -- Main lift producing surface of the vehicle.

Wing -- Stores attached to or within the wing.

Zero Length -- Launch system which takes no ground run leading up to takeoff point.

RECOVERY SYSTEMS DODT
(Dwg. No. 6810-02-2498)

The following is a list of definitions of the terms used in the Recovery Systems DODT.

Aft of Nose -- Refers to inlet aft of forward extremity of fuselage.

Air -- Recovery techniques resulting in bringing vehicle under physical control while it is still airborne.

Air Bag -- An inflated device to absorb landing shock.

Air Cushion System -- An inflated skirt or bag which serves as ground effect flotation to replace standard type landing gear.

Airfoil -- The cross-section of the wing or tail surface in a plane cut parallel to the fuselage centerline.

Airframe Configuration -- The distribution of shape and size of airframe components.

Ancillary Equipment -- AGE, test and checkout equipment, and maintenance equipment.

Angle of Attack -- The angular orientation of the wing with respect to the on-coming air required to maintain a specified flight condition.

Area -- The area of the wing or tail surface planform shape.

Available Launch/Recovery Space -- Space within the vehicle which can be occupied by recovery equipment.

Bottom -- Exhaust at bottom centerline of fuselage.

Center -- Exhaust centered or nearly centered on fuselage centerline

Component Location -- Spares occupied by components and/or systems other than recovery.

Cross Section -- The size and shape of the fuselage envelope at various lengthwise locations.

Decelerator -- A device or operation used to reduce the speed of the vehicle.

Descent Velocity -- The velocity at which the vehicle contacts the ground when suspended from a parachute system and is dependent upon size, number, and type of parachutes employed.

Drogue Chute -- A small parachute deployable at fairly high speed providing sufficient drag to slow the vehicle.

Engine Exhaust Position -- Location of exhaust for combustion products and cooling air for the propulsion system.

Engine Inlet Position -- Location of inlets for combustion air and cooling air for the propulsion system.

Expendable -- Refers to a type of parachute which is used only once.

External -- Stores attached in such a manner as to remain outside the contours of the airframe, e.g., pylons or racks.

Forward of Rear -- Exhaust plane forward of aft extremity of fuselage.

Fuselage -- The central pod or enclosure to which wings and tail surfaces are attached.

Fuselage -- Stores attached to or within the fuselage.

Fuselage Bottom -- Inlet location on bottom centerline of fuselage.

Fuselage Side -- Inlets on sides of fuselage including inlets at wing-fuselage junction.

Fuselage Top -- Inlet location on top centerline of fuselage.

Gear/Wheels -- Standard wheel landing gear.

Gross Weight -- The total weight of the vehicle including all fuel and removable loads.

Ground -- Recovery technique which results in the vehicle reaching the ground without physical control.

Ground Arrest -- Arrest of a very low flying vehicle by a ground cable, e.g., similar to a carrier landing arresting gear.

In-Flight Arrest -- Capture of the RPV in flight by a parent aircraft.

Internal -- Stores contained within the contours of the airframe.

Lateral G-Load -- The aerodynamic and inertial forces on the airframe in a side-to-side orientation normalized by vehicle weight.

Length -- Nose to tail dimension of the fuselage.

Longitudinal G-Load -- The aerodynamic and inertial forces on the airframe in a front-to-back orientation.

Logistics Requirements -- Personnel, equipment, and facilities needed to keep a system in operational status.

Maintenance -- Personnel, equipment, etc., required to keep the RPV system in an operational readiness status.

Mid-Air Retrieval System -- Capture of a suspending cable on the RPV by a helicopter while the RPV is descending on a special parachute system.

Minimum Safe Airspeed -- The minimum airspeed at which the vehicle will remain airborne with an appropriate safety factor above the stall speed.

Nose -- Refers to inlet at forward extremity of fuselage.

Number of Personnel -- Size of required O&M group.

Operation -- Personnel, equipment, etc., directly involved in checkout and performance of the RPV mission.

Parachute -- A canopy inflated by ram air at low velocity which lowers the vehicle to the ground at relatively safe velocities.

Personnel Skills -- The types of skills and levels of competence required to perform Operations and Maintenance (O&M) tasks.

Pitch-Up -- Manipulation of control surfaces to raise the nose of the vehicle producing decelerating drag due to increased angle of attack.

Planform -- The shape of the wing or horizontal tail surface as projected vertically from above or below. Also the shape of the vertical tail surface as projected perpendicular to the side.

Position -- The location of both horizontal and vertical tail surfaces on the fuselage or wings.

Pre-Recovery Operations -- Any functions performed to render the RPV ready to initiate recovery.

Rear -- Exhaust located at aft extremity of fuselage.

Recoverable -- Refers to a parachute which can be repacked and reused.

Recovery -- The terminal segment of the mission which involves those steps necessary to return all or part of the vehicle to a base for reuse.

Re-Engage Towline -- Engagement of a towing point on the vehicle by a parent aircraft with a towline which tows the RPV to a landing site.

Replacement of Consumables -- Replacement of any items or equipment not intended for re-use.

Rotor -- A rotary wing system based on the principle of an autorotating helicopter.

Safety -- Special tests, equipment, and personnel required to insure safety of O&M group and nearby uninvolved personnel.

Separation of Payload -- Mechanism by which payload is separated from RPV if entire RPV is not to be recovered.

Shock Attenuator -- A device which absorbs landing impact energy thereby reducing or preventing vehicle damage.

Side -- Exhaust on side of fuselage.

Skids -- Fixed or retractable devices on the underside of the vehicle on which it can slide after contacting the ground.

Special Facilities -- Those facilities unique to an RPV system which would not be presently available at the proposed RPV base of operation.

Speed Brake -- An extendable surface on the vehicle which produces decelerating drag.

Spike -- A pointed extension which absorbs energy as it penetrates landing surface.

Steerable -- A parachute or parawing device which exhibits the characteristics of a marginal airfoil and has moderate guidance capability.

Stores Location -- Location of any/all equipment, munitions, and fuel pertinent to the mission without destroying the basic aerodynamic and/or structural integrity of the vehicle.

Structural Requirements -- The strength of the airframe structure required by a potential recovery system and the associated dynamic environment.

Tail Surfaces -- The airfoil surfaces which provide lateral and longitudinal stability and control.

Top -- Exhaust at top centerline of fuselage, including location at base of vertical fin.

Tor-Shok -- A mechanical shock absorber device similar to a shock strut.

Tow-On -- Landing of a towed vehicle by flying it very near or onto the ground before releasing the towline by the parent aircraft.

Training -- Development of skills required of operation and maintenance personnel.

Vertical Descent -- A parachute system which lowers the vehicle to the ground nearly vertically without guidance.

Vertical G-Load -- The aerodynamic and inertial forces on the airframe in a top-to-bottom orientation.

Volume -- Volume of each compartment available for recovery equipment.

Volume -- Volume available for stores at each available location.

Weight -- Allowable weight which can be installed at each location.

Wing -- Main lift producing surface of the vehicle.

Wing -- Stores attached to or within the wing.

AIRFRAME DODT
(Dwg. No. 6810-02-2500/Sheets 1-4)

Composite -- Any combination of one or more individual material types.

Launch -- That phase of the RPV mission which involves getting the vehicle into a flight condition.

Recovery -- The terminal phase of the RPV mission which involves bringing the vehicle back to the ground at the desired location.

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